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LECTURES ON MOTOR ANOMALIES*

VIII. PARALYSIS OF INDIVIDUAL EYE MUSCLES: ABDUCENS-NERVE PARALYSIS

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By far the most frequent isolated paralysis of an ocular muscle is that of the external rectus. It is due to the fact that the abducens nerve has a longer course on the base of the skull than both the other motor nerves of the eyes, and is exposed to injuries more than the others, particularly where it passes around the apex of the petrosal portion of the temporal bone. In recent abducens pareses the diagnosis is easily made from the restriction of the outward ocular movement, the uncrossed diplopia due to the convergent position of the visual lines, and the increase and decrease of the separation of the double images according to whether the eyes are moved either to the paretic or the other side. But exceptions to the typical behavior occur rather frequently and may render the diagnosis more difficult. These may be caused by different factors; first, by the behavior of the antagonist of the paretic muscle which, as was mentioned before, may or may not develop a secondary contracture and change the typical features of the paretic deviation in such a way that they become more or less similar to a nonparetic strabismus.

Sometimes one encounters cases which display all the symptoms of an abducens-nerve palsy, with the sole exception that the homonymous double images are not on the same level and that they are slightly inclined toward one another. This may be due either to a complication of the abducens-nerve palsy with a concomitant hyperphoria or paresis of one of the vertical motors, or the muscle plane of the external rectus may not coincide with the horizontal meridian of the eye. One may assume the last-mentioned factor to be the cause if the vertical and rotary components of the deviation are rather small in comparison with the horizontal component, and if only the latter increases or decreases in the typical manner according to the direction of gaze. The other components of the deviation may represent a subordinate (secondary) function of the paretic muscle and its antagonist, due to their asymmetrical adjustment to the eyeball. The secondary contracture of the antagonist will either outlast the paresis if it is based on an organic change of the structure of the internal rectus, or it may represent only a transitory stage if the deviation is based on an increased tonus of the internal rectus; if it subsides gradually, the deviation will decrease until binocular vision is restored.

The congenital deficiencies of abduction need special discussion because of their rather frequent occurrence and the peculiarities they present when compared with ordinary pareses of the abducens

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Fig. 26 (Bielschowsky). Congenital deficiency of abduction. A, in looking straight ahead no deviation whatever, binocular single vision. B, the left eye does not respond to the levoversion impulse. C, retraction syndrome takes place in dextroversion: high degree of enophthalmos and narrowing of the palpebral fissure of the left eye.

nerve. The main characteristics of congenital deficiencies of abduction are as follows:

1. In more than 60 percent of the cases, a total lack of abduction is to be found in the left eye, in 16 percent it is in the right, and in 24 percent in both eyes.

2. Sixty percent of the patients are of the feminine sex.

3. Besides the lack of abduction there is a deficiency of adduction in 50 percent

Fig. 27 (Bielschowsky). Extremely high deviation in a case of bilateral congenital deficiency of abduction due to abnormal tissue in place of the internal recti muscles.

of the cases. The deficient adduction is combined, as a rule, with a more or less marked retraction of the eyeball and a narrowing of the palpebral fissure ("retraction syndrome"). (Fig. 26.)

4. In spite of a complete lack of abduction the majority of the patients have binocular single vision owing to an habitual turning of the head to the side of the deficient abduction.

5. There is a striking contrast between the unilateral total lack of abduction and the very small paralytic deviation which, in many cases, is hardly noticeable, even when the head and gaze are in the primary position. Only exceptionally, one meets with extremely high deviations due either to a maximal contracture of the internal rectus muscle, or to the presence of abnormal fibrous tissue in the place of that muscle and fixing the eye in a strongly adverted position (fig. 27).

6. In most cases diplopia is absent, due either to unilateral amblyopia, which occurs not infrequently or—much more frequently—to binocular single vision, which is achieved by the habitual (vicarious) position of the head, the movement of which makes up for the absent movement of the eye.

7. In quite a few cases the congenital deficiency of the lateral movements is combined with an upward deviation that takes place when an impulse to an adversion is given, just as has been described in the discussion of the so-called overaction of the inferior oblique. In some cases of the former group a faulty development of the internal rectus has been found. Its tendon was divided into two branches, one being inserted in the

horizontal meridian but behind the equator so that it acted as a retractor bulbi, while the other branch was inserted in the upper half of the sclera near the insertion of the superior rectus.

8. Most striking features are presented by patients with a congenital bilateral deficiency of abduction and bilateral facial paralysis. Bell's phenomenon as well as the complete immobility of the face are most impressive (figs. 28A, B and 29A, B, C).

Fig. 28 (Bielschowsky). Congenital bilateral deficiency of abduction combined with bilateral facial paralysis. A, no paralytic deviation in the primary direction of gaze. B, Bell's phenomenon most impressive.

9. In many of these congenital deficiencies of ocular movements other congenital anomalies have been ascertained: either a poor development or a complete absence of the thyroid gland, epicanthus, unusually marked asymmetry of the halves of the face, and other abnormalities.

Fig. 29 (Bielschowsky). Same anomaly as shown in previous figure. A, no deviation in looking straight ahead. B, eyes respond to any lateroversion impulse with a maximal convergence; C, Bell's phenomenon very marked.

The peculiarity of the clinical phenomena in cases with congenital deficiencies of ocular movements is to be attributed to anatomic irregularities, which have been found in patients who had been operated upon. In most of them the deficiency of the ocular movement was due to a faulty development or a complete absence of the muscles. In place of the external rectus was found a nonelastic fibrous band, either without any or with only very few muscle fibers. Its incapacity, both to relax and to contract, and, furthermore, the resistance it offers to the contraction of the internal rectus accounts for some of the characteristics of the congenital anomalies such as the missing, or very small paralytic deviation; the lack or insufficiency of adduction; and the retraction phenomenon. The narrowing of the palpebral fissure in cases with the retraction syndrome is an accessory phenomenon accompanying the retraction of the eyeball to which the lids remain attached. In some cases the external rectus may be found to be fairly normal, while in place of the internal rectus there is a nonelastic band, resisting active as

well as passive outward movement of the eyes, that is held in convergent position without being able to turn in to the normal extent. In other cases of the anomalies under discussion, a faulty development of the motor nerves and their nuclei has either been found—for instance, an aplasia of the sixth and seventh nuclei in cases of congenital bilateral paralysis of the sixth and seventh nerves—or must be assumed.

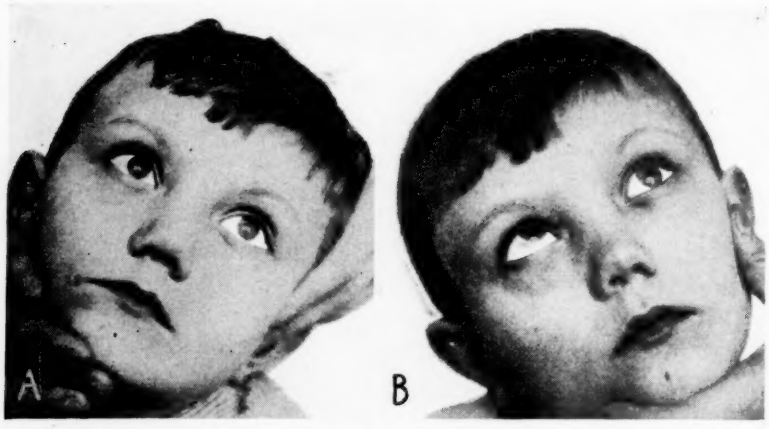

Fig. 30 (Bielschowsky). Torticollis of ocular origin in a case of right trochlear paresis. A, binocular single vision with head tilted toward the left shoulder. B, maximal vertical deviation with the head tilted to the right.

As to the therapeutic procedures in congenital motor anomalies, there is no need for operation if binocular single vision in the central part of the field of fixation can be attained by a slight turning of the head. In other cases with either a disfiguring paralytic squint or an anomalous position of the head, operations cannot be dispensed with. They will be discussed together with the treatment of paralytic squint.

Paralysis of the trochlear nerve

By far the most frequent and important type of paralysis of a single vertical motor is trochlear-nerve palsy—most important because not infrequently there are variations which lead to a wrong diagnosis. From my material comprising several thousand cases of ocular paralyses, I can state that isolated trochlear palsies occur at least half as often as abducens palsies. Most statistics give too small a number of trochlear palsies, obviously because frequently these palsies are not recognized or are misconstrued. The most striking sign in many cases is habitual torticollis; that is, a tilting of the head toward one shoulder. The ocular origin of torticollis is often not recognized, especially in cases of congenital trochlear-nerve palsy or those acquired in early childhood (fig. 30A, B). The general practitioner or the surgeon who is first consulted about torticollis frequently takes it for a contracture of the sternocleidomastoid muscle, although there is neither a contracture which can be felt nor a resistance to the passive straightening of the head or to its being tilted toward the opposite side.

I have observed many such cases in children who had to endure various kinds of orthopedic treatment for several years, naturally without the least effect. As soon as the physicians or the parents discontinued the forced straightening of the child's head, it was tilted toward the same side as before the treatment. At last the physician advised the parents either to punish the child because of the "bad habit" or to divide the sternocleidomas-

toid muscle. But when the operation was done, the child did not cease to tilt the head, as before. In several cases the child's mother was the first to discover the ocular origin of the position of the head by observing that the child closed one eye during the forced upright posture of the head, whereas both eyes were opened as soon as the child was allowed to keep the head tilted in the habitual way. This observation was correct: The habitual position of the head helped the child to secure binocular single vision, whereas to avoid a disturbing diplopia arising from straightening the head the child closed one eye. These children discard the anomalous position of the head spontaneously as soon as the balance of the vertical motors of the eyes is restored by the required operation, which I shall discuss later.

The ocular origin of this kind of torticollis was first recognized by Cuignet,[1] in 1873; he could not, however, explain the connection between the ocular disorder and torticollis any more than could Landolt[2] in 1890, in his paper on ocular torticollis. Without knowing the problem under discussion, A. Nagel[3] in 1871 had supposed that in cases of slight paresis of an elevator or depressor muscle a vertical and rotary deviation would be caused by tilting the patient's head toward one side, a supposition based on the discovery that a parallel rotation of the eyes around the visual axis is produced by tilting the head towards the opposite side. As we now know, parallel rotation of the eyes is due to a reflex innervation of vestibular origin. The parallel rotary movement could only be performed, as Nagel presumed, by both the inferior muscles of one eye (inferior rectus and inferior oblique) and at the same time by both superior muscles of the other eye (superior rectus and superior oblique). The combined action of the two superior muscles as well as that of the two inferior muscles cannot cause a deviation of one of the visual lines provided the two muscles of each pair are equally strong, for in that case the antagonistic components of those muscles will compensate each other and there can result neither a vertical nor a lateral deviation of the visual axis. The only effect of the combined action of these two muscles is the rotary movement which they produce in the same direction.

Let it be supposed that in a case of right trochlear-nerve palsy the head is tilted toward the right shoulder. From this will arise a vestibular excitation of those muscles that are able to produce a parallel rotary movement of the eyes to the left. This movement is produced in the left eye by the two inferior muscles, and in the right eye by the two superior muscles. The paralyzed right superior oblique muscle can no longer compensate the elevating and adducting component of the right superior rectus, from which a vertical and a lateral deviation of the right visual line must result, whereas in a normal person both the visual axes would be stationary. And what will happen if the head of the patient with the paretic right superior oblique muscle is tilted toward the left side? Both inferior muscles of the right eye and the superior muscles of the left eye receive the vestibular innervation to rotate the eyes around the visual axis to the right. This movement can be performed without the coöperation of the paretic muscle; hence no deviation of the visual axis will result. As mentioned before, the more the sound muscles are burdened the more favored will be the paretic muscle. Now one can understand the reason for the habitual tilting of the head that is observed in so many cases of trochlear-nerve palsy: If the head is tilted toward the shoulder of the sound side, a coöp-

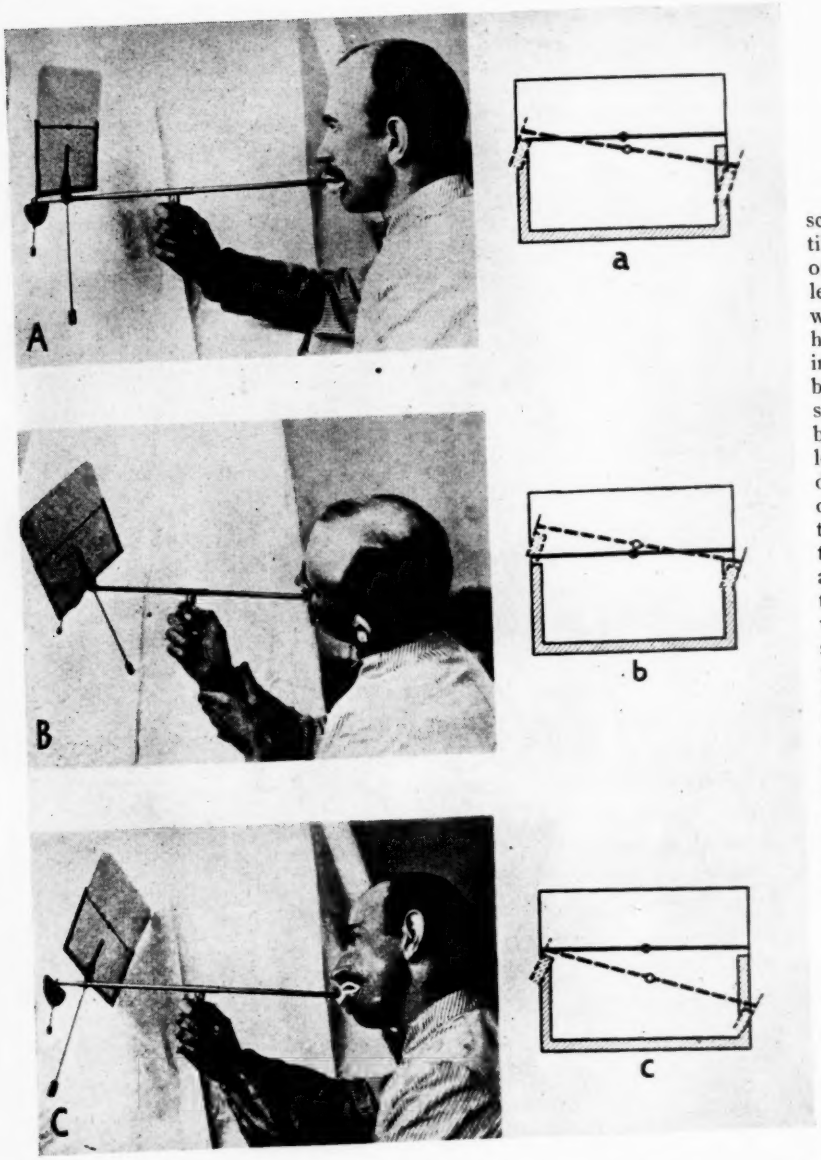

Fig. 31 (Bielschowsky). Head-tilting test in a case of bilateral trochlear paresis. A, while the patient's head is erect, two images of the fixed black stripe are seen, the lower one belonging to the left eye (reproduced to the right of the figure). B, the vertical separation of the two images is increased by tilting the head toward the left shoulder. C, the opposite kind of vertical divergence is brought about by tilting the head toward the right shoulder, which makes the paresis of the right trochlear nerve manifest.

eration of the superior oblique muscle is not called for, so that binocular single vision is obtained.

Nagel's supposition has been proved correct by the investigations made by Hofmann and me[4] in 1900. In that publication the explanation given by other authors concerning the tilting of the head in cases of trochlear-nerve palsy was discussed and proved wrong. But, strange to say, that wrong explanation has found currency to this day in many later articles on the subject. It is said that the paretic eye, deviated upward by tilting the head, is depressed as far as necessary to bring both visual axes to the same level, so that the vertical distance between the double images is removed and only a small lateral distance remains, which can be easily corrected by a convergence or divergence

innervation. The error of this explanation can be recognized at once. If a prism of 10 degrees, base up or down, is placed before one eye and the head tilted alternately toward either side, the two images will be seen at the same height, but only in respect to the horizontal plane, so that if an effort is made to converge the double images pass each other without meeting. The direction in which they are moving will deviate from the direction in which they are seen moving with the head erect, by the same angle which the basal line of the eyes—that is, the line between both nodal points—includes with the horizontal.

There is another argument against the wrong explanation just mentioned: In cases of nonparetic vertical divergence or of paresis of the superior or inferior muscle the tilting of the head does not influence the distance between the two images. Therefore, this peculiar posture of the head will be found only if the balance of the oblique muscles is disturbed, provided that the patient can get binocular single vision at all.

I have not yet been able to find out why the tilting is of no use in palsies of the vertical recti, although these muscles help to bring about rotation of the eyes around the visual axes necessitated by tilting the head toward the opposite side. According to my experience, paresis of the superior or inferior oblique is in all cases at the bottom of ocular torticollis, provided that only by this posture can binocular single vision be obtained.

It may be stated in brief, that in some cases of trochlear-nerve palsy the habitual position of the head differs from the one just described because the patient chooses the most convenient position of the head that relieves the paretic muscle enough to permit binocular single vision. Cases will be encountered in which the head is turned toward the sound side, so that the visual line of the paretic eye, because it is now turned out, is not acted on by the oblique muscles. A habitually depressed position of the head in cases of trochlear-nerve palsy is seldom encountered.

For an exact investigation of the influence that the position of the head just discussed exerts in certain cases of vertical deviation, one may use a simple apparatus constructed on the principle of Helmholtz's *Visierzeichen* (fig. 31A, B, C). While the patient's head is fixed by his taking between his teeth the little plate at one end of the rod, he looks at a horizontal black stripe on a piece of white cardboard fixed to the other end of the rod 30 inches (75 cm.) away. The rod is put through a short tube, so that when the patient tilts his head it rotates around the same axis and through the same angle as the head. In this way it is insured that the visual line keeps its direction during the tilting of the head, since the cardboard with the fixed stripe keeps pace with the movement of the head, in respect to both the amount and the direction. A patient with a left trochlear-nerve palsy using this little apparatus will see, while his head is erect, two images of the black stripe, the image belonging to the left eye being below the other image and both converging to the left side (fig. 31a). When the head is tilted toward the left shoulder, the vertical distance and the obliquity will increase considerably (fig. 31b), whereas tilting of the head toward the right shoulder makes the two images come to fusion or in a case of bilateral paresis brings about the opposite vertical divergence (fig. 31c).

The deviation caused by a trochlear palsy is made up of several components, the vertical one being the most important in point of diagnostic value. In typical

cases the vertical deviation increases in looking down as well as in looking to the sound side, according to the physiologic function of the superior oblique, which has the main influence on the depression of the eye while the visual line is turned in; whereas, if the latter is turned out, the only effect the superior oblique has on the eye will be an inward rotation of the vertical meridian. Bearing this in mind one has to expect that the vertical distance of the double images will increase in looking down because the paretic eye will lag behind, while in looking up there will be the minimum, if any, vertical diplopia. In looking to the sound side, the disturbance of balance between the oblique muscles will become more and more noticeable: The paretic eye will deviate upward under the influence of the inferior oblique which is not, or insufficiently, counterbalanced by its antagonist. In looking to the paretic side, the vertical position of the paretic eye depends less and less on the oblique muscles. Therefore, the vertical deviation will decrease more the more the paretic eye is turned out. But in that position the loss of the rotary component of the superior oblique will bring about the maximum of obliquity of the double images; whereas, the latter will appear parallel in the opposite part of the field of fixation where the function of the oblique muscles is confined to the vertical component (fig. 32).

The photograph shows the two images in various parts of the field of fixation in a typical case of trochlear-nerve palsy. The patient is fixating the little lamp in the middle of the tangent scale. By turning the patient's head, while he is ordered to fixate the lamp continuously, his eyes are made to turn to the left side and the right, up and down, up and to the left or to the right, and so on. The measurement of the various components of the deviation obtained in this way is not very exact but is sufficient for the diagnosis and as basis for comparing the results of later examinations with those of the first.

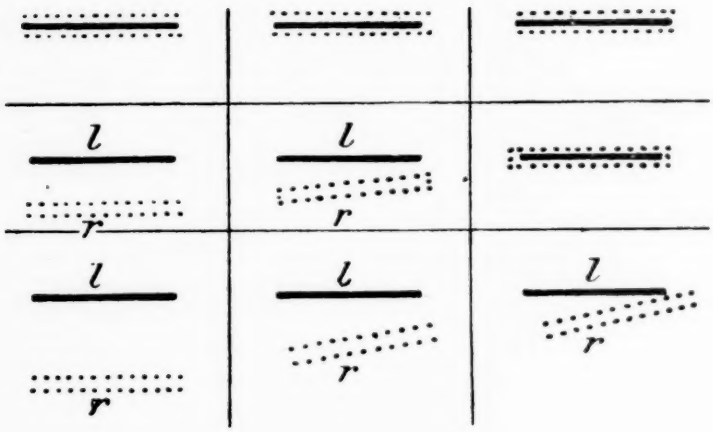

Fig. 32 (Bielschowsky). Double images (r and l) of a horizontal object in the various parts of the field of fixation, in a case of right trochlear palsy.

From what was said about the behavior of the paretic deviation in the various parts of the field of fixation, it is easily understood that a patient with trochlear-nerve palsy will instinctively try to bring the objects that attract his attention into that part of the field of fixation where he will see them singly. He can achieve this either by rotating his head around the frontal axis so that the chin is pressed

against the chest, or by turning the head around the vertical axis toward the sound side. In either case, the object looked at may be seen single since the eyes are brought into a position where the paretic muscle is considerably unburdened. A habitually depressed position of the head in cases of trochlear-nerve palsy is very seldom met with because it is rather inconvenient. More frequently, the head is turned habitually toward the sound side so that the patient looks at an object straight in front with the visual line of the paretic eye abverted. But this position of the head will be satisfactory only in cases with very slight trochlear-nerve palsy because it does indeed do away with the vertical deviation, but not with the meridional disclination due to which disturbing diplopia, particularly in reading, may remain, double images of the vertical lines crossing each other at acute angles. Hence, the majority of patients with trochlear-nerve pareses will show a habitual tilting of the head toward the shoulder of the sound side, sometimes combined with a rotation of the head around the vertical axis toward the same side. By that position of the head, the paretic superior oblique is unburdened completely and the patients do not feel any discomfort. It goes without saying, that patients with ocular paralysis will demonstrate an anomalous position of the head only if it relieves them of diplopia. If binocular single vision cannot be obtained by any vicarious position of the head or if unilateral amblyopia prevents a disturbing double vision, the head is held in its ordinary position. Sometimes existing anomalous positions of the head are given up if the paretic deviation increases to an insuperable degree.

As in cases of abducens-nerve palsy, not infrequently trochlear-nerve palsy also gradually loses its typical features by the development of a secondary contraction of the inferior oblique muscle, the antagonist of the paretic muscle, while the latter is recovering. In such a case the vertical distance of the two images no longer increases on looking down or decreases on looking up. Changes in the amount of vertical divergence take place only when the patient is looking from left to right; the vertical divergence increases in the direction of the sound side and decreases in the opposite direction, whereas the contrary is found with respect to the meridional (rotary) deviation, just as in the first stage of the paresis. Why does the change in the type of the paresis not extend to the influence of the lateral movements on the vertical divergence, so that the deviation becomes concomitant in the whole field of fixation as in abducens-nerve palsy? The influence of the vertical motor muscles on the position of the eye at a given moment depends on the angle between the visual line and the muscle planes of those muscles. If the visual line is abducted, the oblique muscles have no influence on the vertical position of the eye, whereas their influence increases the more the visual line is adducted. These conditions are not altered when an originally paretic vertical deviation is maintained at a later stage only by a contracture of the antagonist of the paretic muscle. If such a case is encountered and the first stage of the paresis is not known, it is difficult to decide whether the deviation is to be connected, for instance, with a palsy of the left trochlear nerve or with a paresis of the right superior rectus muscle. In either case the behavior of the vertical deviation is the same, increasing if the patient looks to the right and decreasing if he looks to the left. The small lateral component does not matter, as was said before. Not even the obliquity of the two images is sufficient for the differential diagnosis, as has been discussed previously.

In such cases the head-tilting test will help to find the origin of a paresis. The patient observes the two images of the black strip on the cardboard screen. If, for instance, the vertical distance between the two images increases when he tilts his head toward the left shoulder and decreases or disappears when he tilts it the other way, one may conclude that the change in the vertical distance is caused by a disturbed balance of the left oblique muscles, the superior oblique being too weak in relation to its antagonist. If in the head-tilting test vertical distance does not show the aforementioned difference, one may take it for granted that the muscles of the left eye are intact, but the right superior rectus muscle is too weak in relation to its antagonist. Since this test has proved to be true in several hundred cases of the palsy under discussion which I saw before the atypical stage developed, I know that it is absolutely reliable, positive results always indicating that the change in the vertical distance between the images is caused by the oblique muscles.

The atypical vertical divergence just described is similar to that anomaly, previously discussed, which gives the impression of excessive functioning of one or both inferior oblique muscles. The anomaly in most of the latter cases is congenital and in some of them distinguishable from the atypical vertical deviation due to a secondary contracture of the inferior oblique by an absence of the meridional disclination of the vertical meridians, and sometimes also of a vertical deviation in the primary direction of gaze.

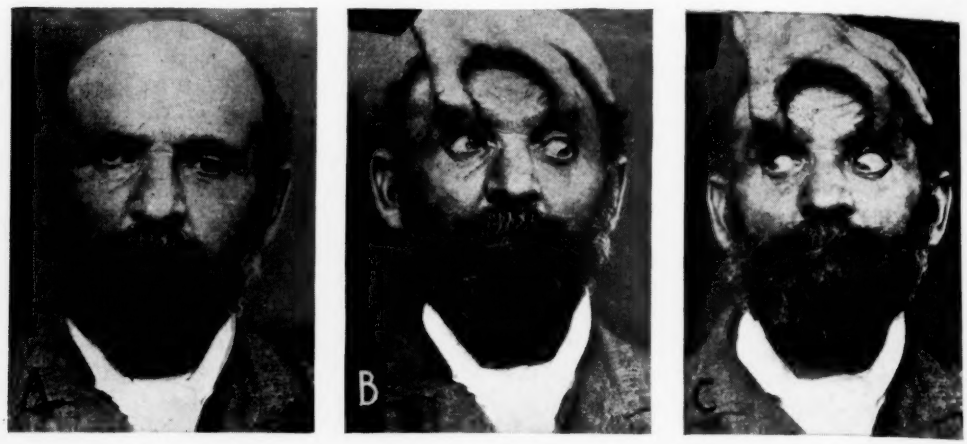

Fig. 33 (Bielschowsky). A, permanent secondary deviation of the normal left eye in a case of right trochlear palsy. B, upon looking down and to the left the right visual line cannot be lowered at all. C, upon looking down and to the right, however, the right eye does not lag behind the left eye.

If the paretic eye has better vision or has been dominant since childhood it is used for fixation and the patient presents a permanent secondary deviation of the sound eye. In the photograph (fig. 33A, B, C) the left eye is deviated downward. The deviation disappeared in dextroversion and increased to maximum in levoversion. At first glance one was led to think of a paresis of the left superior rectus, but the next photograph shows that in looking up and to the left both visual lines are elevated equally. That one was dealing with the secondary deviation of the right eye in a case of complete

paralysis of the left superior oblique, was proved by the position of the eyes in the lower part of the field of fixation; moreover, by the positive result of the head-tilting test. The habitual secondary deviation of the nonparetic eye was due to hyperopic astigmatism of the latter. The vision was less than two-thirds of normal, while the paretic eye had full uncorrected vision.

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AMERICAN OPHTHALMOLOGY GROWS UP: TURBULENT YEARS FROM 1908-1915*

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On January 30, 1938, a medical news story broke in the New York Sunday papers. It rated well over a column on the front page of the Education Section. Judging by the headlines, interest centered in its promise of a curb on the specialists in medicine. It predicted that, by 1940, before they started practice, the qualifications of these specialists would be tested by a national board.

The story was well told, and it properly censured the self-appointed specialist. It did not mention, however, the fact that the ophthalmologists had for years operated just such an examining board; that it was the genius of a few of their leaders that conceived this plan; and that only their careful experience and experiment had made possible the larger scheme, with 12 special boards and a coordinating advisory body. There was, indeed, no mention made of the ophthalmic board, although three of the younger boards were named. The truth of the matter is that in these few years the perspective has become so blurred that the sharp outlines of events leading up to the movement for examining specialists have disappeared. Only to those of us who have had special interest in the work is the American Board of Ophthalmology more than just one of the many specialty boards—one of the last, in fact, to be recognized by the authorities. Yet it is believed by the men who were interested in this project that, besides being the pioneer in testing specialists, the ophthalmic board has also been the source of the present stir in graduate medical training. If this is a fair statement, it seems only reasonable to claim this new impressive examining structure as a monument to those of our specialty by whose ingenuity and foresight it was conceived 25 years ago. The object of these remarks is to place a modest wreath in their honor.

Records of the period are either lacking or disappointingly discreet. There are, of course, no minutes for the Board itself prior to its organization in 1915. Its circulars simply state that, in 1913, the three national ophthalmologic organizations appointed a joint committee. This committee, after holding various meet-

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ings, emerged with the project of a joint examining board. As a consequence, in 1915 there was organized what is now the American Board of Ophthalmology. The chronicles of the Board record nothing to suggest that the process was not so simple a one as has just been described. In reality, for a period of years, various groups had been wrestling with unprecedented problems in ophthalmologic sociology. It was by the momentum thus generated that this machinery was set in motion.

The law takes for granted, as medical men know, that any graduate in medicine is qualified, without additional study, to declare himself a specialist. Consequently, at the turn of the century, specialism, and more especially that dealing with diseases of the eye and ear, found itself infested by charlatans. After a severe winter had exhausted the general practitioners, the more prosperous communities would acquire a plague of "mushroom specialists," many of whom had hardly moistened their lips at the Pierian spring.

Those who were interested in this state of affairs during the first decade of 1900 will probably recall three needs: First, to provide facilities for proper graduate training; second, to arrange for testing the qualifications of specialists; and finally, and most difficult, to induce these practitioners to submit to such a test.

The Transactions of the American Ophthalmological Society and those of the Section and the Academy—to use the shorter names for the Section on Ophthalmology of the American Medical Association and for the American Academy of Ophthalmology and Oto-Laryngology—read as though by 1908 ophthalmology had suffered a little colic from its bolus of partly trained specialists.

The chairman's address at the meeting of the Section in 1907 rather exemplifies the period then closing. It was a discourse of much elegance with the title, "The duality of man." Its unfettered scope is shown by the closing promise to "reveal what spirit is, provided some one would tell what is matter." The following year someone began to tell what was the matter. Fittingly, the speaker was William H. Wilder, of Chicago, for many years afterward the secretary and wise and kindly autocrat of the ophthalmic board. On June 2, 1908, at the First Presbyterian Church in Chicago, in his address as chairman of the Section, Wilder discussed the need for coöperation in the speciality, and that fall, at the meeting of the American Academy of Ophthalmology and Oto-Laryngology, four of the papers were in the same vein. Derrick Vail the elder, in his president's address, said: "It should no longer be possible to be called an oculist after a month or six weeks in a postgraduate school." Vail suggested that a year or two of internship in general medicine, followed by a sufficiently long term in an ophthalmologic institution in America or abroad, should be required, after which he proposed that the student should appear before the proper examining board, one similar to any state board of examination and registration, in order to obtain a license to practice ophthalmology. This plan for a state authority for registration in ophthalmology was suggested repeatedly thereafter. Why it was never adopted was due partly, perhaps, to the difficulty of getting the law enacted. Then, too, with various cults clamoring for recognition, it presented hazards that it may well have seemed wise to avoid.

Laertus Connor, of Detroit, made a startling plea for the teaching of "ophthalmology for students of general medicine." Connor reported that a poll of a county medical society in Michigan showed that the members had never

heard a lecture on refraction, nor been taught how to refract. Most of their eye cases went to opticians. To remedy this condition he advocated that "as much instruction in ophthalmology as possible be given to undergraduates without violence to other courses." They should be enabled to recognize and treat all eye injuries except those concerning intraocular foreign bodies; all eye infections; diseases of the uvea; also what he termed simple hyperopia, simple myopia, and simple presbyopia. This was an undisguised attempt to compete with refracting opticians, and will be discussed more fully further on.

Edward Jackson, of Denver, without criticizing Connor's plan, deprecated "teaching the medical student that the crude guessing he can do after the instruction given to large classes in our medical schools will do justice to patients suffering from eye strain." Jackson's suggestion was that when the last year of the medical course is devoted to electives, a sufficient time should be allotted to this kind of work.

Wendell Reber, of Philadelphia, was more outspoken. He said: "Until a man has looked at a thousand eyegrounds . . . his opinion is worse than useless: it is dangerous. Why burden him with half learning a technique that is a waste of time?" Replying to Casey Woods's paper, he said: The refinements of ocular pathology are absolutely postgraduate work."

The chairman's address at the 1909 meeting of the Section at Atlantic City can be regarded as a keynote speech. Alvin A. Hubbell, of Buffalo, though, perhaps, not so original as Wilder, whose remarks had inspired him, "had the knack of selecting the salient points out of even a complicated question and making it clear and easily comprehended by the average reader." Hence it is fortunate that he chose to assemble and present the diverse topics that were being discussed. Evidently the importance of his inaugural address made a lasting impression, for his biographer for the American Ophthalmological Society made especial mention of it. This reference would be more complimentary if either the subject or the year were correctly stated. Hubbell advocated a required course in ophthalmology for undergraduates, checked by examinations before both the medical faculty and the state licensing board; and for specialists, thorough postgraduate study and clinical work, followed by examination for practice by expert ophthalmologists. He advised that committees be appointed to start proceedings.

This was a remarkably prompt answer to Wilder's call for coöperation, even making allowance for a receptive frame of mind due to threats of outside competition. Of the three activities that followed, two started bravely and failed. The third resulted in the organization of the American Board of Ophthalmology.

1. Simple refracting by family physicians

To understand the agitation for "simple refracting" requires a picture of its champion. Laertus Connor, of Detroit, previously mentioned, will probably be remembered chiefly for his ability as an organizer. Massive and robust, he was a dominating figure in all medical circles. Besides holding executive offices in most local and state medical organizations, he had served as chairman of the Section on Ophthalmology and as president of the American Medical Association. As founder of the Council on Chemistry and Pharmacy, and as a member of the committee that launched the Journal of the American Medical Association, his influence endures. Connor was a powerful

advocate for any plan he sponsored. He was appointed to the committee to consider the recommendations in Hubbell's chairman's address. With Connor on the committee, it was inevitable that it would recommend his plan for teaching ophthalmology to undergraduates and general practitioners.

By 1910 it emerged as the Committee on Family Physician Refracting. That Connor was appointed chairman was not surprising. The committee's report envisioned a refracting army of 130,000 doctors, thus, according to them, covering an estimated group of 180,000,000 human eyes. On analysis it is clear that the statistician responsible for these figures was in error. Nevertheless, the committee had accomplished no mean task. Thus, they had approached all the state boards; they claimed to have persuaded four, those of Nebraska, Michigan, Vermont, and Utah, to make a knowledge of refraction one of the requirements for a license to practice medicine; to have secured endorsement of the plan by periodicals, including the conservative Boston Medical and Surgical Journal, and by General Gorgas, the president of the American Medical Association. In Connor's own state of Michigan a license was being granted only to applicants who could "demonstrate upon living subjects with simple spherical lenses their working knowledge of refraction." Charles A. L. Reed, ex-president of the American Medical Association, called this the logical remedy for the optometric evil. The House of Delegates endorsed the appointment in every state of a committee to coöperate with the national committee on Family Physician Refracting. In many states, including Maine, this committee was actually appointed. During the following year Laertus Connor died, and the whole elaborate structure vanished. It did not simply fall to pieces for there were no pieces left, it sank without a ripple!

2. Optometry committee

Mystery surrounds the 1908 report to the Section by Wilder and Lucien Howe, of Buffalo, who comprised the Committee on Legislation Concerning Opticians. There are no records of their recommendations except that they were referred back for revision. Instead of presenting this revision, the following year the committee requested to be discharged. The reason given was that the members had been made chairmen of other important committees and could not give the necessary time to this one. John C. Bossidy, of Boston, and James Thorington, of Philadelphia, were thereupon appointed, without evasion, as a Committee on Optometry. Their report to the 1910 meeting advocated "no recognition and no compromise" and was accepted. The committee also persuaded the Section and the House of Delegates, in which Bossidy represented the Section, to express their disapproval of ophthalmologists serving on boards with opticians in examinations for licenses in the mechanical examination of eyes. Similar action was also taken by the American Ophthalmological Society. Bossidy's committee was discharged at its own request in 1912, having compiled the American Medical Association Bulletin on Optometry. It is unnecessary to state that opposition to optometry assayed almost total loss. When the agitation ceased, the result was the recommendation to introduce a restraining clause into optometry bills. The report written by Wilder, as chairman of the Optometry Committee of 1913, recommending this was not fully concurred in by his associates, Edgar S. Thomson, of New York; E. C. Ellett, of Memphis; John Green, Jr., of Saint Louis; and Hiram Woods, of Baltimore; the latter the Section chairman. The clause prohibited the sale of lenses to persons with defective vision, squint, or diseased eyes without a physician's prescription, and

precluded the use of the title "doctor." It was a variant of the "Jackson" clause, used effectively in Colorado and Maryland.

3. Graduate education

Jackson had been adroitly swinging the feeling against the optometrists behind his struggle for improving ophthalmologic training. In 1911 he read a paper at Los Angeles on "The optometry question and the larger issue behind it." He first punctured the slogans used so devastatingly by the optometrists in their struggle for recognition. One still remembered is, "A lens is not a pill." "No more," declared Jackson, "is a hypo syringe a pill, or a thermometer, or a knife." He then proceeded to upbraid the ophthalmologists for the predicament they had gotten themselves into. This was the larger issue. "The most important thing that the medical profession has to do is to provide adequate teaching for ophthalmology. Failure properly to perform this duty to the public," he charged, "is responsible for the optometry question."

The first effect on the meeting was to arouse indignation against optometrists, and especially against those general practitioners who, by sending patients to the optometrists, were responsible for the disastrous neglect of emergencies like glaucoma and brain tumors. Finally, F. Park Lewis, of Buffalo, brought the discussion back to the subject of education by saying that "we are never going to get rid of optometry by simply opposing it."

Year by year Jackson's efforts increased in effectiveness. His paper of 1911, just mentioned, had persuaded the Section and the House of Delegates to pass a resolution that, as ophthalmology requires certain subjects not demanded for the degree of M.D., all medical schools possessing the facilities should establish graduate courses of one year in ophthalmic institutions. In 1912 Jackson addressed an evening session of the Section in Atlantic City, taking as his subject the curriculum leading to the degree of Doctor of Ophthalmology, describing the experiments at Oxford and Liverpool, and his own course at the University of Colorado. This address impelled Samuel D. Risley, of Philadelphia, to deride the postgraduate students "who came for six weeks to a polyclinic to learn refraction and spent their time wandering from clinic to clinic to watch operations; in Europe they got even less out of it because the language was imperfectly understood. Finally there was no way of rating their proficiency." The truth of these charges has been borne out remarkably by the subsequent experience of the American Board of Ophthalmology. These men, who have taken disconnected short courses here and there, have been found to make the poorest showing, and those who have pursued this type of training abroad attain the lowest grades.

There was still no answer to the problem of inducing students to undertake these courses. Why would the average specialist, whose state license permitted him to practice, devote two years to this needless pursuit? And then why should he struggle with a perfectly gratuitous examination?

4. The joint board

The establishment of a state examining board seemed still to be desirable, but no one cared to undertake its organization. The first feeble gesture toward the unique project of an unofficial joint board issuing a certificate to be required for society membership was apparent at the 1913 meeting of the American Ophthalmological Society when John E. Weeks of New York moved to refer to a committee the stiffening of the require-

ments for membership. This action had been urged on behalf of the membership committee by the chairman, George E. de Schweinitz, of Philadelphia. The newly appointed committee was instructed to formulate standards for the proposed Doctorate of Ophthalmology. In his presidential address, Myles Standish, of Boston, had declared that it would be a very diverse degree with the variety of colleges authorized to grant it. It is ironical that he should have been the one to inaugurate a new venture. He was small, competent, as irascible as his Puritan antecedent, but as stand-pat as Plymouth Rock.

It is in the report of this "Committee on Diploma in Ophthalmology" that the primary interest of this article centers—not in what it says, but in what it omits to say. De Schweinitz was chairman of the committee, and the other members were Standish, Risley, Jackson, and Weeks. These men outlined the curriculum that should lead to the proposed degree, and explained the reason for making it Master in Ophthalmology in preference to several other obvious titles. They provided also for a thesis and an examination, but evidently both were to be ranked by the university authorities. The significant thing was the absence of the slightest intimation of a joint examining board. The one step in that direction that can be detected after a painstaking review of the records is a suggestion by de Schweinitz that his committee be combined with that from the Section and from the Academy. This was solely with the purpose in mind of bringing more pressure to bear upon the medical schools for the establishment of graduate courses.

By inference, the project of the joint board must have been conceived during the month elapsing between the meeting of the American Ophthalmological Society at Hot Springs in May, 1914, and that of the Section in June. As was just stated, Jackson, chairman of the Section committee, was also a member of the American Ophthalmological Society committee, and had signed their report, and four other members of the Section committee, Woods, Wilder, Zentmayer, and Duane, were present at the Hot Springs meeting in May, 1914, and took part in the discussion concerning it. Zentmayer, in particular, was scrupulous to avoid ambiguity in the wording. It seems incredible that they were considering so radical an enterprise.

The report was presented to the Section in June. Jackson observed that the experience of the Royal College of Surgeons of England and that of the Royal College of Physicians of London pointed the way to a practical method of certifying. The members of their conjoint examining board were drawn from 21 schools. Although the board conferred no degree or right to practice, rejected 40 percent of the candidates, and demanded fees of $210, nevertheless a large proportion of the men entering practice took the examination. Jackson recommended the formation of a board in this country on a similar basis. To complete the arrangements, he advised inviting the coöperation of committees from the American Ophthalmological Society and the Section on Ophthalmology.

It will be observed that there is still no intimation of the provision that the certificate of the Board would be required for membership in the American Ophthalmological Society and the Academy, and for officers and positions on the program of the Section. This seems not to have been proposed until the proceedings of the joint committee were reported in 1915. In that year the American Opthalmological Society did not meet until July, at New London, Connecticut. This document, which was formulated by the chair-

men of the three committees, was therefore first submitted to the meeting of the Section at San Francisco, under the chairmanship of E. C. Ellett, of Memphis.

One object of this study was to determine how much the formation of the Board was assisted by the optometrist agitation. The opinion of those active at the time is well worded in a letter from John E. Weeks, in which he says: "In regard to the influence of optometrists in bringing about the formation of the American Board for Ophthalmic Examinations, their statement that many ophthalmologists did poor work in refraction could not be denied. Their contention had much to do with causing Connor to propose 'simple refraction for family physicians,' but it was only one of the stimuli that were instrumental in the creation of the examining board, and not an important one."

This ingenious means for persuading oculists to prepare for and take examinations by requiring the certificate of an independent board for society membership is credited to Edward Jackson. This was the culmination of his prolonged relentless warfare on incompetence in the profession, begun at least 30 years previously.

For later consideration are the organization of the Board and its development. That the devoted group associated with Jackson began conducting examinations in 1915 is now history. Up to 1938, in spite of the early plaints by those who resented what they pleased to miscall a "self-appointed tribunal," 55 examinations had been held and 1,440 candidates had been certificated in all parts of the United States and in Canada. In conducting these examinations many of the most distinguished opththalmologists have been associated with the Board, and leading hospitals have generously provided facilities for them. The certificate has been made a requisite for membership in many sectional and local societies and on hospital staffs. This has had the intended effect of compelling universities and hospitals to formulate courses in preparation for the examination. A characteristic example of the improvement in education has been the introduction, into residencies, of systematized courses of instruction. The most far-reaching and spectacular result of this enterprise, however, has been the adoption of the board method of examination by 11 other specialties and their coördination in the advisory board for medical specialties.

Discussion

Dr. George F. Libby, San Diego, California: At Dr. Beach's request, I am glad, after listening to his interesting paper, to speak briefly of the bearing of Colorado on the movement which he has so well described. In 1912, under the auspices of the University of Colorado and with Dr. Edward Jackson's direction, we established in Denver a postgraduate school for advanced teaching in ophthalmology. There were 11 students—one from Pennsylvania, two from the Middle West, and eight from Denver. Dr. Crisp and I were both students and lecturers in that course, which was of six weeks' duration. Local men and some leading ophthalmologists from other parts of the country lectured and held clinics. In the following year, after a year's reading in ophthalmology under Dr. Jackson's direction, three of us, having passed the examinations, received the degree of Doctor of Ophthalmology at the state university. I am speaking of this because

I believe that the Colorado movement leading to the certification of men who had taken advanced standing in ophthalmology, and also the courses given at that time in the University of Pennsylvania and in the University of Minnesota, leading to the degree of Doctor of Science in Ophthalmology, had a very important bearing on the development of the American Board of Ophthalmology. As I understand the matter, it seemed far better to the men who started the movement to have a national board of examination certify to the attainment of high standing in ophthalmology, rather than to serve that purpose by a doctorate degree; and I think that was the wiser way. I simply wish to express my appreciation of what Dr. Jackson did in Colorado and in our country in helping toward the establishment of this movement. I am thankful that I had a small part in starting the work. As I was at that time 44 years of age, I was told by the younger ophthalmologists that when I stepped up as the first registrant for the course they felt ashamed not to follow. At this time it seems appropriate for me to touch upon what was done in Colorado, and by our Dr. Jackson, to help this movement along.

Dr. W. B. Lancaster, Boston: The Society is grateful to Dr. Beach for this important historical contribution. Perhaps you think it is a simple matter to write such a paper: that all you have to do is to look up the records in the Transactions and find out what was done year by year! There is a great deal more to it than that. The historian must evaluate what he finds and interpret it for us, and, besides, the records are very meager. They simply say, "it was moved and carried, etc." Take the epoch-making meeting of last night; when the future historian tries to find out the facts, he will simply be confronted with the record, "moved and voted." Nothing will be said of how Horatio held the bridge, who fought on his right hand, and who on his left hand, and what soldiers stood behind him, and how they met the onslaughts of the reactionaries and the diehards!

Perhaps you think that when the American Board of Ophthalmology was formed matters were all peaceful, but I assure you that was not the case. When the Board first made its appearance many a finger of scorn and ridicule was pointed at it by men in high position. But we were fortunate, in those days, in having for leaders men of vision and of courage, especially of vision, who could see the future while we were still in a fog, and did not see the shining heights above; men who led us on to great achievement, so that now we are proud to have the stone which was rejected by many made the headstone of the corner: Ophthalmology leading all the specialties, from otolaryngology to surgery.

Dr. William H. Crisp, Denver: In the future we shall say: "There were giants in those days."

CONTRIBUTION TO THE THEORY AND PRACTICE OF TONOMETRY*

II. An analysis of the work of Professor S. Kalfa with the applanation tonometer

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Baltimore

In the previous paper[1] a theoretical analysis was undertaken to distinguish the influence of ocular rigidity from that of intraocular pressure on tonometric measurement with the Schiötz tonometer. A method was devised whereby these two components of the tonometric reading could be separately evaluated and their independent variations studied. It is much to be regretted that at the time of publication of this study, the writer was unaware of the important contributions which Professor S. Kalfa of Odessa had already made to this subject.[2, 3, 4, 5, 6 7] Since much of Kalfa's work may be unfamiliar to the American reader, the present article will be devoted, first, to a review of Kalfa's work in this field; second, to an attempt to relate that work to the study of the Schiötz tonometer.

In his investigations, Professor Kalfa has used the Maklakow tonometer, an instrument of fixed weight with a small plane surface as its base (fig. 1). Measurements are made with this instrument as follows: After 1-percent holocaine anesthesia, a drop of concentrated solution of bismark brown in water and glycerine is allowed to spread over the cornea. The flat base of the tonometer is now allowed to rest on the cornea for a moment and then a print is made of the area of corneal contact by pressing the tonometer on a piece of paper. The diameter of the print or "tonogram" is measured with calipers. Duplicate measurements are said to agree to 0.1 or 0.2 mm.**

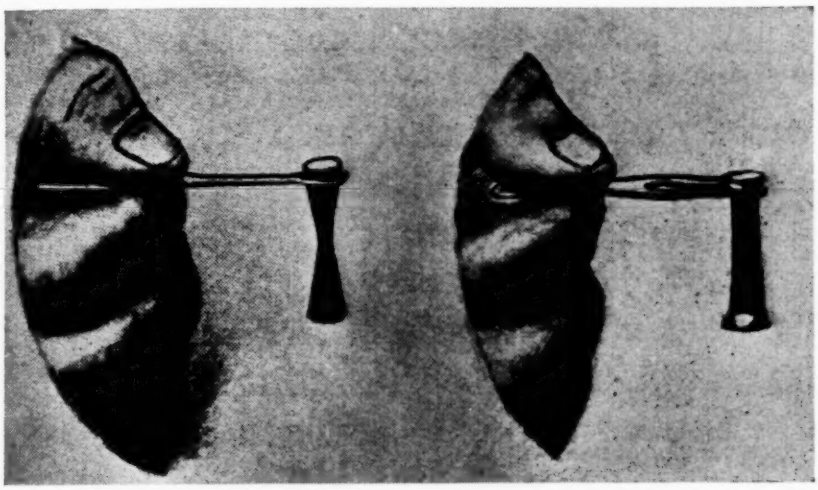

Fig. 1 (Friedenwald). Maklakow tonometer (after Lloyd).

* From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

** Applanation tonometry has not been widely used in this country and is generally re-

Kalfa first proved that the act of tonometry with the Maklakow tonometer raises the intraocular pressure. This was accomplished through direct measurements on enucleated eyes of animals and of human beings. The eyes were connected with a manometer through a canula placed in the optic nerve. The intraocular pressure could be brought to any desired level, and the connection to the manometer could be left open or closed. When the tonometer was allowed to rest on the cornea it was regularly found that the intraocular pressure was higher; that is, the area of applanation was smaller when the connection between the eye and the manometer was closed than when it was open. As further evidence, the author was able to show that if, after tonometry, the Maklakow tonometer is allowed to rest on a normal eye for two minutes, at the end of which time a fresh tonometric measurement is made, one finds the pressure regularly lower on the second tonometry than on the first. This shows that the tonometer, while resting on the eye, raised the intraocular pressure and expressed some intraocular fluid. Finally, Kalfa made use of Maklakow tonometers of different weights and showed that the tonometric measurement regularly yielded a higher reading when a heavier tonometer was used.

From these observations Kalfa concludes that the intraocular pressure is raised by the act of tonometry, and that the true intraocular pressure is somewhat less than that indicated in the tables published by Golowin.* How much the act of tonometry changes the intraocular pressure depends among other things on the elasticity of the eyeball. Since tonometers of different weights produce different changes in intraocular pressure, a comparison of readings made with tonometers of different weights on the same eye can yield information concerning the elasticity of the eyeball. Filatow had previously prepared a set of Maklakow tonometers weighing respectively 5.5, 7.5, 10, and 15 grams, and these were placed at the disposal of Kalfa. In using this set of tonometers, the latter measured first with the lightest instrument and then with successively heavier instruments. On normal eyes the successive measurements invariably yielded successively higher pressure readings when the pressure was determined with the Golowin tables. The results for a single case or the average results for a group of cases may be charted as shown in figure 2, the pressure as ordinate, the tonometer weight as abscissa. The author denotes such a graph as an "Elastometric curve." Such curves obtained on normal people usually approximated straight lines. The slope of the curve, or more specifically the rise in pressure from the 5.5 to the 15 gram reading was used as a measure of rigidity. This may be designated "Elastometric Rise" or E. R. Evidently of two eyes with the same intraocular pressure the one with the greatest E. R. is the more rigid.

In 100 normal eyes the average E. R. was 9.9 mm. Hg, with 7.1 and 12.1 as the lower and upper limits. The E. R. increases with age, the greatest changes being before the age of 20. In progressive myopia the E. R. is noticeably less. In untreated glaucoma the E. R. is greater than normal and the elastometric curves are often irregular with steps or peaks, heavier weights sometimes yielding lower pressures than previously used lighter weights. Most irregular curves are ob-

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garded as less accurate than indentation tonometry. The relative merits of the two procedures are, however, irrelevant to the present discussion.

* Tables based on the law of Fick and Maklakow, see below.

tained in treated glaucoma. Kalfa has devoted special attention to the irregularities in the elastometric curves in glaucoma, and has used these to study the vasomotor reflex regulation of intraocular pressure, a subject of great interest which does not, however, concern us here.

The simplicity of the approach to this problem that Kalfa has achieved with the applanation tonometer stands in marked contrast with the complex treatment that a similar analysis of the measurements with the Schiötz tonometer required. The validity of both methods is supported by the widespread agreement in clinical observations achieved independently. Without by any means disparaging the simplicity of Kalfa's solution, it may be pointed out that this simplicity has been reached through the neglect of one feature in the elastic reactions of the eyeball. It is evident that if the pressure in two eyes is equal, the eye that has the steeper elastometric curve is the more rigid, but the analysis of Kalfa provides no means of comparison between eyes with unequal pressures. Just as variations in elasticity introduce errors in pressure readings in ordinary tonometry, so variations in pressure introduce errors in rigidity readings, for the tonometric reading that is the basis for determination of either pressure or rigidity is actually determined jointly by these two features.

In order to separate rigorously the pressure and rigidity factors in the tonometric measurement, an analysis similar to that which was undertaken previously in relation to the Schiötz tonometer is required. When the tonometer rests on the cornea it deforms the cornea and displaces fluid equal to the volume of the deformation. This displaced fluid is accommodated within the ocular cavity by a stretching of the ocular coats and by a displacement of some blood from the intraocular vessels. Depending on the resistance that is offered to this displacement, a greater or smaller rise in intraocular pressure will occur. In the previous paper it was shown that for any given eye the same volume displacement always produced the same percentage of change in pressure. Stated mathematically:

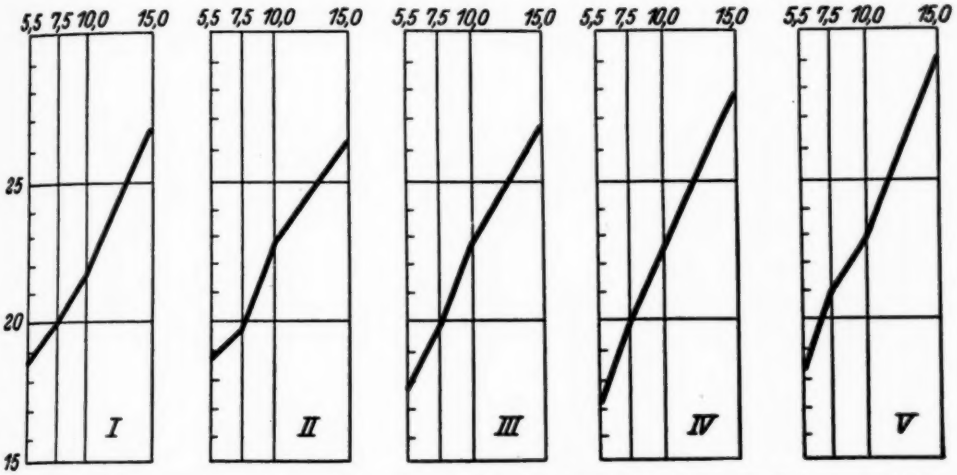

Fig. 2 (Friedenwald). Elastometric curves of Kalfa (see Ref. 5, p. 277). I, 7-year-old boy; II, average of 14 patients aged 10-14 years; III, average of 10 patients aged 15-19 years; IV, average of 9 patients aged 20-25 years; V, average of 10 patients aged 30-55 years.

$\text{Log } P_2 - \text{Log } P_1 = K(V_2 - V_1) \ldots (1)$
Where K is a constant characteristic of the eye measured, hence K may be taken as a measure of ocular rigidity.

In order to determine K we must know the values of P and of V; that is, the actual intraocular pressure and the volume of the corneal indentation corresponding to tonometric measurements with different weights. When these paired values of P and V are known, they can be charted on a scale that is linear with respect to volume and logarithmic with respect to pressure. Such points fall on straight lines and the slope of the line drawn through them is a measure of K. The value of K, so determined, has been designated the coefficient of rigidity. It is independent of the particular range of pressure over which the determination is made.

Owing to the complex form of the corneal indentation produced by the Schiötz tonometer, considerable complexity was encountered in determining what volume of indentation corresponds to given tonometer readings. In respect to the applanation tonometer, no such complexity exists, for the volume of the displaced fluid may be assumed to correspond to that of a segment of a sphere having the tonogram for base and the undistorted cornea for dome.* Table 1 gives the volume calculated to correspond

TABLE 1

RELATION OF DISPLACED VOLUME AND INTRAOCULAR PRESSURE CORRESPONDING TO DIFFERENT DIAMETERS OF APPLNANATION AS MEASURED WITH THE MAKLAKOW TONOMETER

Diameter of Applanation mm.	Volume Displaced mm.³	Pressure in mm. Hg with Various Tonometer Weights			
		5.5	7.5	10	15
2.0	0.1	128	175	230	350
2.5	0.2	64	88	115	175
3.0	0.5	57.7	78	105	157
3.5	1.0	42.3	57.5	77	115
4.0	1.6	32.4	44.2	59	88
4.5	2.7	25.8	35.2	47	70
5.0	4.1	20.9	28.5	38	57
5.5	6.0	17.1	23.3	31.0	46.5
6.0	8.0	14.4	19.6	26.2	39.3
6.5	11.7	12.3	16.7	22.3	33.5
7.0	16.1	10.6	14.4	19.2	28.8
7.5	21.0	9.2	12.6	16.8	25.2
8.0	28.0	8.1	11.0	14.7	22.0
8.5	38.0	7.2	9.8	13.1	19.6

* These simple assumptions yield volume estimates that are only approximately correct. Variations in corneal curvature and the presence or absence of corneal astigmatism introduce errors that could be allowed for only by very laborious calculations. Kalfa has pointed out that during applanation the corneal lamellae probably slide over one another so that the area of the tonogram may be larger than the area of the base of the flattened area on the inner surface of the cornea. Furthermore, capillary attraction may cause some enlargement of the tonogram, and any rocking or slipping of the tonometer or the cornea would have a similar effect. There appears to be no direct method of allowing for these errors. On the whole they should lead to an underestimate of intraocular pressure and an overestimate of displaced volume.

The formula for calculating the volume of a segment of a sphere is: $V = \pi a^2 (r - \frac{a}{3})$ in which r is the radius of curvature of the sphere (in this case 7.8 mm., the average radius of curvature of the cornea), and a is the altitude of the segment. The latter is given by the formula: $a = r - \sqrt{r^2 - R^2}$ in which R is the radius of the base of the segment of the sphere; that is, the radius of the tonogram.

to different diameters of the tonogram, and also the intraocular pressure calculated by the formula of Fick and Maklakow.**

The data of table 1 may now be combined graphically in the chart shown in figure 3, which is analogous to the nomogram for determination of ocular rigidity and pressure with the Schiötz tonometer published in the previous paper. The four curves correspond to applanation tonometers weighing respectively 5.5, 7.5, 10, and 15 grams. The ordinates of points on these curves are proportional to the logarithm of the pressure, the abscissas are proportional to the volume of the displaced fluid, corresponding to a given tonometric reading. If readings are made with the four different tonometers and are plotted on this chart, they should, if our theory is correct, fall approximately on a straight line. The slope of such a line is the coefficient of rigidity of the eye measured. A set of sloping lines for graphic comparison, and the numerical values of their slopes, is included in the upper portion of the chart.

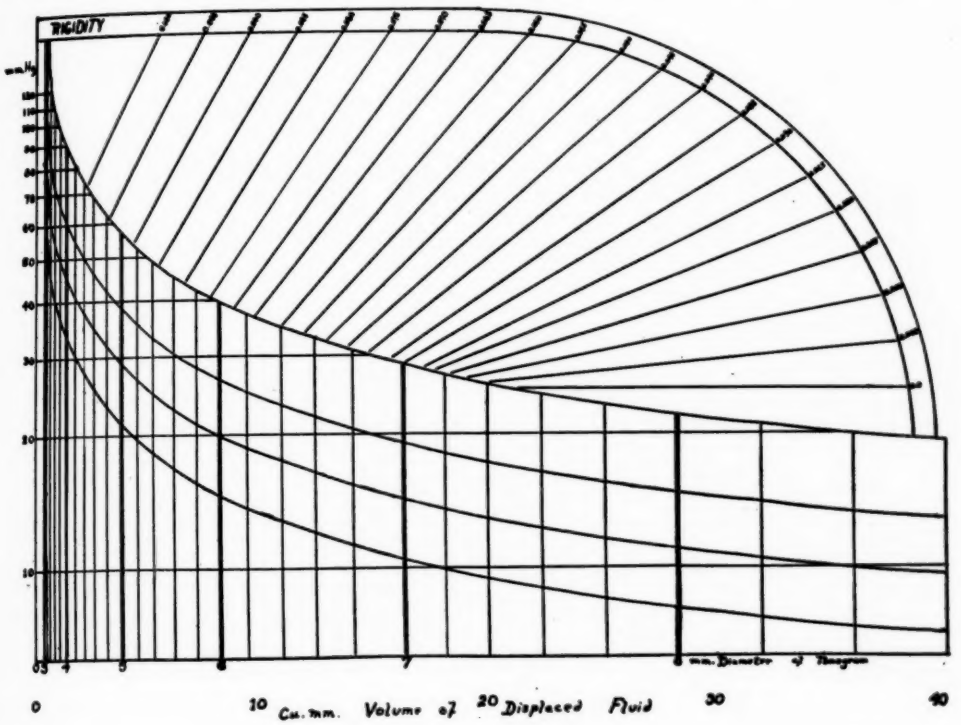

Fig. 3 (Friedenwald). Chart for the determination of ocular rigidity from tonometric readings with the applanation tonometer.

In figure 4 are charted the data of Kalfa that are given in the first and last elastometric curves of figure 2 above. The slopes of these curves are respectively 0.011 and 0.021. The five elasto-

** This formula is based on the necessary equality of the upward force of intraocular pressure operating over the area of applanation and the downward force of the weight of the tonometer: $W = P \times A$. The pressure in grams per square millimeter is readily transformed into millimeters of mercury as given in the table. This portion of the table is identical with that of Golowin referred to above.

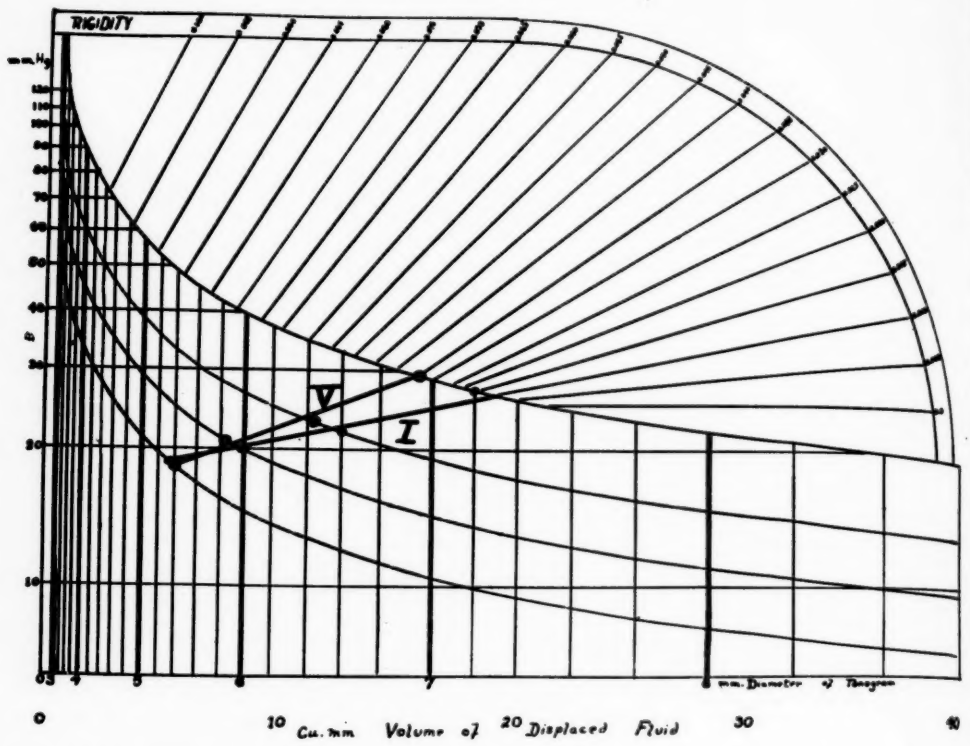

Fig. 4 (Friedenwald). Kalfa's data, from figure 2, charted for determinations of ocular rigidity.

metric curves of figure 2 were presented by Kalfa to show the variation of these curves for different age groups of normal persons. In table 2 the values of rigidity coefficients computed from these five curves are given, and compared with the average rigidity coefficients of corresponding groups as determined with the Schiötz tonometer, and reported previously. Considering the number of simplifying assumptions that were introduced into both calculations the agreement between these two independent sets of measurements is remarkable.

It is evident from the above that the chart given in figure 3 may be used with Kalfa's elastometric diagram as a pair of mutually complementary dictionaries for the translation of values of rigidity coefficient into corresponding values of

TABLE 2

RELATION OF RIGIDITY TO AGE

Kalfa			Friedenwald		
Age	Number of Cases	Coefficient of Rigidity	Age	Number of Cases	Coefficient of Rigidity
7	1	.011			
10–14	14	.011			
15–19	10	.018	15–30	135	.021
20–25	9	.019	30–50	182	.021
30–55	10	.021	50–60	102	.022
			Over 60	81	.029

elastometric rise. This translation is reduced to a single chart in figure 5 in which it is seen that small values of elastometric rise (E. R.) correspond to fairly stable values of rigidity coefficient, irrespective of the pressure level at which the measurement was recorded, but that larger values of E. R. correspond to values of rigidity which vary markedly with pressure. The pressure indicated is that determined with the lightest tonometer (5.5 gm.). Applying this chart to the data given by Kalfa for the maximum range of variation of E. R. (from 1.8 to 27.9) the corresponding range of variation of rigidity coefficient is from 0.002 to 0.100, figures which again correspond to the findings with the Schiötz tonometer.

In respect to the Schiötz tonometer, a method was worked out to obtain a reading for the intraocular pressure independent of the ocular rigidity. A similar and much simpler computation may be made for the applanation tonometer as follows: Let us suppose that tonometric measurements have been made on a given eye with the four different Maklakow tonometers and that the results of these measurements have been charted as four points on the nomogram (fig. 6). A straight line is drawn as nearly as possible through these four points. The slope of this line, as before, is a measure of the ocular rigidity. If we imagine ourselves passing down this line from upper right to lower left, we should be passing through a series of points corresponding to measurements with lighter and lighter tonometers. The point (P) where the line crosses the vertical axis corresponds

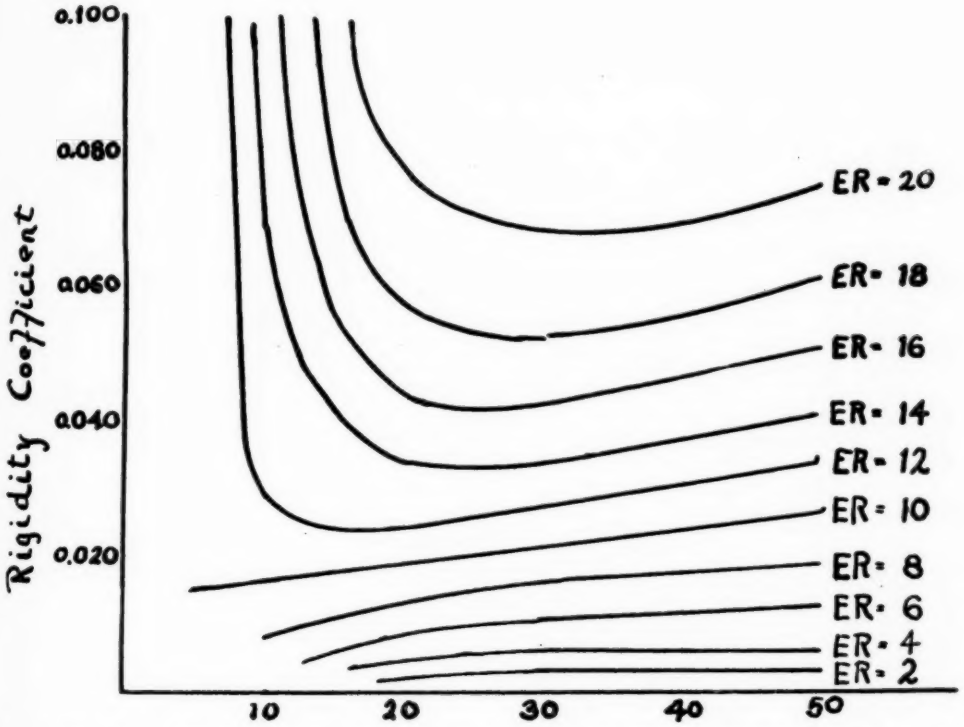

Fig. 5 (Friedenwald). Relation of elastometric rise of Kalfa (E. R.) to rigidity coefficient of Friedenwald is shown to vary with intraocular pressure.

to the measurement with a tonometer of infinitesimally small weight and hence, to the true intraocular pressure undisturbed by the act of tonometry.

Applying this method of computation to Kalfa's data for normal eyes, we reach an estimate for the average normal intraocular pressure of 15 mm. Hg. This figure is in marked disagreement with the results obtained with the Schiötz tonometer from which the average normal intraocular pressure was computed to be 25 mm. Hg. This discrepancy is far too large to be accidental. As indicated above, a discrepancy of this sort was to be expected owing to the fact that the diameter of the tonogram is enlarged by a variety of factors. A simple calculation shows that if the radius of the tonogram as measured were regularly reduced by 0.5 mm., complete agreement could be obtained between the readings with the Maklakow and the Schiötz tonometers in regard to average normal intraocular pressure, and that this adjustment would be achieved without disturbing the already highly satisfactory agreement between the two instruments in the measurement of rigidity.

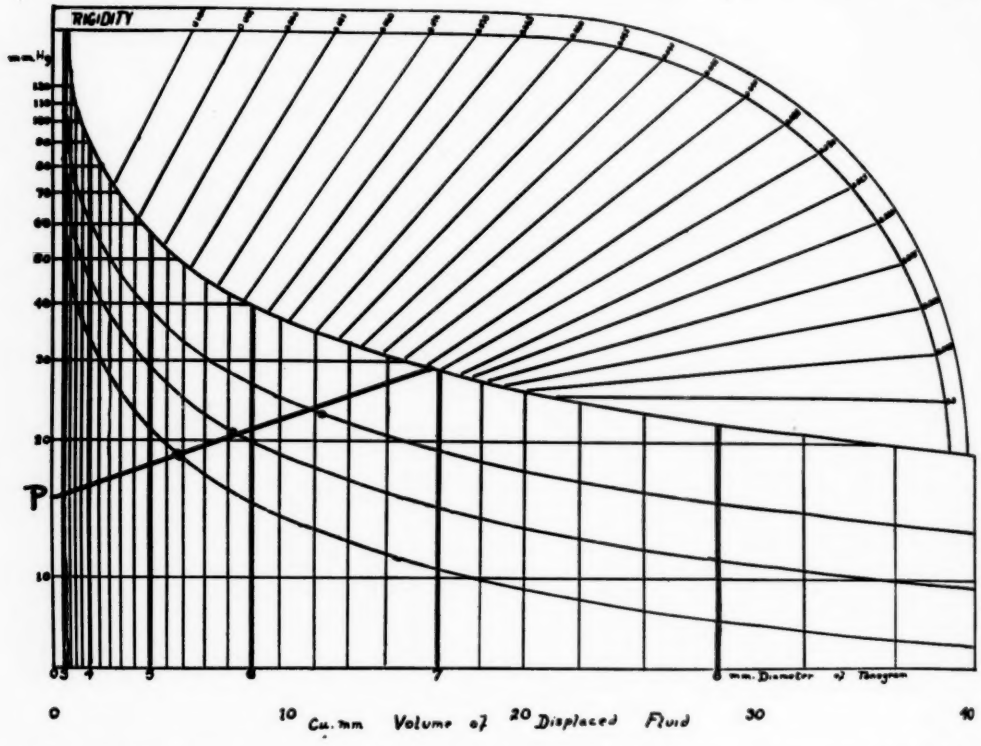

Fig. 6 (Friedenwald). Method of using the rigidity chart to determine intraocular pressure from readings with the applanation tonometer.

In summary, it has been possible to apply to Kalfa's elastometric measurements with the applanation tonometer the same type of analysis that the writer has in a previous publication applied to data obtained with the Schiötz tonometer. The agreement of the results furnishes a most satisfactory check on the correctness of this analysis. The elastometric rise that Kalfa has chosen as a measure of ocular rigidity is shown to

be closely connected with the coefficient of ocular rigidity as designated by the writer. The relation between the two is not linear but, in general, these two measures tend to increase or decrease together. The greatest discrepancies between these two measures is to be found in cases of low intraocular pressure and high ocular rigidity. In this group of cases the rigidity measure of Kalfa gives relatively smaller measurements than that of the writer. It is perhaps on this account that Kalfa failed to note that the ocular rigidity of persons with high myopia was greater than that of persons with low myopia, and also that there is a group of hyperrigid cases among otherwise normal old persons.

The number of cases that fall into this region of lesser agreement is, however, quite small. The results obtained by the two methods are thus capable of confirming and supporting each other.

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SUBJECTIVE STUDY OF VISUAL ABERRATIONS*

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In the foreword to a recent edition of Sir Isaac Newton's "Optics," Einstein wrote: "Fortunate Newton, happy childhood of science! He who has time and tranquillity can, by reading this book, live again the wonderful events which the great Newton experienced in his young days." But the "childhood of science" has not passed; perhaps it is only beginning; and we, by experiment, may also read the open book of nature. Newton's "Optics" explained the rainbow, and laid a broad foundation for others to build upon. But the work of Oersted, Faraday, Kelvin, Clerk-Maxwell, and recent astronomers has pushed aside Newton's theory of gravitation, making place for the "relativity" theory of Einstein. Some of the oldest impressions and observations of vision still remain to be understood and explained.

The earliest representations of the stars and sun closely resemble the representations of them made today. Yet there has been no clear understanding of them. Helmholtz gave a representation of the appearance of "monochromatic aberrations" of his own eyes, but offered no explanation of their significance. Why do we see a star as a point of light?—not a mathematical point, but a bright object, extending irregularly in different directions. A telescope reveals a fixed star as a mathematical point, and a planet as a small round disc, without any irregular extensions. These are the true images formed by a perfect lens or perfect lens systems. What we see are the images formed by imperfect human eyes; and the irregular projections are the effects of the monochromatic aberrations of imperfect eyes, no two of them exactly alike.

These star images may easily be studied by simple experiments, with very simple apparatus. When looking at a star in the evening, close first one eye and then the other: it will be noted that the images in the two eyes differ. The principal projections of light for one differ from those of the other. They extend in different directions, and branch differently. The use of lenses before the eye changes these projections and they vary with the size of the pupil. They exist through optical defects of the eye, and any change in the refractive conditions alters them.

We see the stars through relatively dilated pupils. It is easy, by covering some part of the pupil, to observe just what part of the image is formed by light passing through that part of the pupil. Looking at night at a star, or at a distant street light, the edge of a card may be brought before the pupil. As the edge of the card begins to cover a part of the pupil, a part of the image of the light disappears. The image that remains is formed by the part of the pupil still uncovered. If covering the bottom of the pupil removes the bottom of the image, the part covered is myopic. If covering the bottom of the pupil obliterates the upper part of the image, the aberration of that part of the pupil is hyperopic. If a corner of the card is thrust before the pupil, the part of the image lost will belong to that quadrant of it. In this way each part of the image can be connected with the part of the pupil causing it. When looking at a star through a circular opening, the periphery of the pupil

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will be excluded, making the opening smaller. When the opening is small enough, the aberration of the periphery of the pupil is excluded; and a star may become a point of light, as it appears when observed through a telescope.

Multiple crescent moons are caused by aberrations of the eyes. With a card to cover first one part of the pupil and then another, we can connect each image with the part of the pupil causing it. When a patient complains that he "sees too many moons," a demonstration of how such images are caused may relieve his anxiety, and create a confidence that the physician understands his case and can help him. By such subjective study of his own eyes, the ophthalmologist may watch the progress of changes in them, especially refractive changes.

It is possible to study your own refraction by autoskiascopy,* using one eye to examine the refraction of the other. But the use of the subjective method, by means of a bright star, a distant street lamp, or an automobile headlight as the source of light, is generally more available and more convenient. This method can be taught to patients who are curious or morbid with reference to their own visual defects.

Representations of the sun, a disc of light (too intense to be looked at) with a region of brilliant illumination about it, and rays emanating from it in all directions, are composite images, based on general experience, going back to the early development of the race, that can be confirmed by the experience of each of us. So far as appears, there has been no careful study made of the physical basis of the impressions so expressed. No intelligent study of this phenomenon was possible until, within the last century, we learned the minute anatomy of the eye and the mechanism of visual perceptions. Our subjective studies may further our understanding of visual optics, and may throw some light on the essential basis of vision.

What is now understood of the radiations from the sun and the luminous projections of its corona, as photographed at times of total eclipse, might lead us to explain the radiations we have seen as a general physical phenomenon, apart from vision. But experiment indicates that it occurs not in the sun or our atmosphere, but only in our eyes—a phenomenon especially suited for individual subjective study.

This appearance may be observed by the old experiment of looking at the reflection of the sun in a globule of mercury with a background of black velvet. This gives us a point of bright light at the center, with a background so dark that the single rays may be seen diverging in all directions. Such an image can also be seen at night by looking at a bright electric light far enough away to appear as a point. It is now most frequently seen in the reflections of the sun from the curved, polished surfaces of an automobile. It may best be studied by looking at the sun, or its reflection, through a very small opening in a metal plate, keeping the retina dark-adapted by the exclusion of other light.

When studied through a small opening, which may be shifted in front of different parts of the pupil, it is found that the divergent rays are reflections from the substance of the crystalline lens, very near to its anterior pole. The only structures that can give such reflections from that part of the eye are the surfaces of the lens fibers converging to their anterior attachments. The minute anatomy of these converging fibers has not been studied with reference to this particular optical effect; but for the glass membrane

* Jackson, E. Ophth. Rev., 1897, v. 16, p. 227.

that covers them, or the particular lens Y to which they are attached, to cause such radiating lines is most improbable. The number of these fibers and the arrangement of their broader sides fit them to such reflections of the light falling upon them.

It must be remembered that in an eye with clear media, the rays we see are not like pencils of light passing through a smoke chamber. They are produced only by the light that has fallen on the sensitive layers, the percipient elements, of the retina. Light is invisible in the transparent media of the eye, just as it is when passing through the transparent atmosphere. The red rays of sunset are not visible in clear air. They are manifest only as they fall on clouds, smoke, or other visible objects. The radiating lines seen in the eye are the impress of light falling on radiating lines of retinal percipient elements. They are visible only through parts of the retina that are situated so as to receive them, and sensitive enough to be affected by them. They generally extend for 10 or 20 degrees from the fixation point, and sometimes twice that distance. The extent of the area of the radiating lines is dependent on the brightness of the source of light and the retinal light adaptation. They are not seen in the area of the physiologic blind spot. But this cannot be sharply outlined, because that requires light adaptation, whereas the perception of the radiating lines requires dark adaptation.

Another optical phenomenon allied to that just described is the radiations seen diverging from bright lights; these are caused by the reflections of light from the moist edges of the eyelids. This manifestation also has not received the attention that its frequency entitles it to receive. These bands of light, extending upward or downward, or both upward and downward, may be seen on gazing at any bright source of light when the pupil is wide enough to extend to the lid margins. Such bands of light have doubtless been observed by every one, but they have been regarded as only a kind of glare, which may be dispelled, changing the relation of the lids to the direction of the source of light; opening the eyes widely, or looking in another direction, or closing the eyes. The direction of the band of light is perpendicular to the direction of the part of the lid margin from which the light is reflected. If these reflections come from near the center of the lids, where the margins are parallel, one coming from the upper lid will go directly down, and one from the lower lid will point directly up. If the reflections come from the lid margins near either canthus, they take correspondingly oblique directions. When the lids are almost closed, their margins are so nearly parallel to the direction of the light rays that can reach them that these reflections are not noticed. When the eyes face a very strong light, the pupils contract, so that the reflections from the lid margins do not reach the pupil. When the pupil is dilated, the light reflected from either or both of the lid margins is an important part of the glare that patients complain of as the effect of the use of mydriatics. When we look at the reflections of the sun from the curved surfaces of an automobile, the reflections from the lid margins may be seen along with the radiating lines of the reflections from the anterior pole of the lens. The breadth and direction of the lid reflections distinguish them from the radiating lines caused by the lens.

It is probable that the reflections of strong light from the lid margins and the crystalline lens to the interior of the eye have an important influence on the metabolism of the retina. They diminish the excessive brightness of images formed on one part of the retina, and distribute

a part of the light to all portions of the pigment layer of the retina, without preventing the perception of retinal images useful for vision. They should be considered in relation to retinal nutrition, or light and dark adaptation.

We cannot assume that only the light coming from a strong visible source, like the sun, is reflected in that way. The light from every source, including the diffuse light of the sky on this same reflecting surface, is reflected in the same way. With feebler sources of light, however, the radiating lines in which they are reflected would not be perceived by the retina, constantly adapted to the total light falling on it. In this way a large part of the light entering the pupil is uniformly diffused over the pigment layer of the retina.

From the enormous influence on plant life of light falling on the chlorophyl and allied substances in the leaves we can best conceive the importance of this diffuse light constantly falling on the pigment layer of the retina. The loss of visual acuity, when the percipient layer of the retina is separated from the pigment layer by detachment of the retina, gives us an idea of the vital importance of the normal retinal pigment in the mechanism of vision. The same lesson is enforced by the defective vision always found with albinism, which impairs the choroidal and retinal pigmentation of the eyes. The physiology of vision is so complex and unexplored a subject that we need every possible assistance, by the subjective study of our own vision, to help us assign the relative importance of measures available for ocular therapeutics or preventive medicine.

The subjective study of the reflection of light from the crystalline lens may also be of diagnostic importance. Pursuing the line of entoptic investigation described by Donders, studies of the writer's own eyes have revealed unsuspected opacities in both crystalline lenses near the anterior poles. Through an aperture 0.5 mm. in diameter the opacities were observed to be always of the same shape, they were seen very close to the anterior pole of the lens, and were brownish-gray in color. In this case, these have probably been left by a long-completed process. But lesions detected by this method of examination might be watched through their early active changes, when they would reveal something of their nature and causation. The lens substance, highly specialized and generally remaining transparent for many years, is a tissue about which we know little, and which we should study in order to be able to prevent cataract formation.

Subjective study of phenomena in the borderland between vision, neurology, and philosophy may also be a corrective, for there is a tendency for examinations of patients to become habitual, routine, and unproductive. It may help us to learn to retard the development of senile changes, and to avoid professional failures and disappointments.

Republic Building.

Discussion

Dr. W. B. Lancaster, Boston: The conventional idea of a lens pictures the rays of light from a point P falling on the lens and then all of them focused to a point P′ on the other side of the lens. This is not even approximately true. The rays falling on the lens are correctly represented as all emanating from a point P, but after refraction these rays do not all go to the point P′. If we take the central ray and the two adjoining it (an infinitely small beam), these do meet at

a point, but none of the peripheral rays are refracted to this same point. The result is that we have a congeries of rays crossing one another, not all at one point, but at many points. Much the same is true of the eye. The rays from a point after refraction by the cornea and the lens do not meet at a point. If the pathway of the rays is studied, it is found that the rays are grouped together so that if cross sections are made at various points by letting the rays fall on a screen and observing the images when the screen is at different distances, it is found that, at a point slightly posterior to the schematic focus, the rays are well concentrated at the center, but are surrounded by scattering rays like whiskers, which Dr. Jackson spoke of as radiating sometimes 20 degrees or more from the center. If instead of a bright light as a source a black spot on a white card is chosen, these whiskers are invisible—too faint to be seen—and we obtain a pretty accurate focus in the center.

If the screen was in front of the schematic focus, then the grouping of the rays would be most concentrated, not in the center but around the circumference, the light being fainter in the center (negative aberration). That does not give a good image.

What the accommodation has to do is to pick out the place somewhere between the anterior and the posterior part of the focal line, as it has been called, where the image is the best for seeing, and that is what the eye is doing all the time, making the best use it can of the muddle of rays by picking out for the retina that cross-section of the beam which, under the conditions, makes the most serviceable image. If you paralyze the accommodation, the eye is unable to select the best place. Moreover, with the enlarged pupil, numerous extra rays are admitted which complicate the picture and compel the eye to select a different point for the best focus. Dr. Crisp made a very keen observation when he stated that in this mixture of rays the eye has a habit of selecting one place which suits it the best, and when, by dilating the pupil, we introduce other rays at the periphery of the pupil, the eye still is able to adhere to its original preferred point, but I do not think we ought to count on that. The eye may do that in some cases, but if we want to learn what the eye does, we must examine it under the conditions in which it is really working, and not limit these at any rate to the conditions under cycloplegia, because then the aberrations are quite different and the eye must make a different adjustment.

Dr. Edward Jackson, closing: This subject is new to me, and is probably new to most of the members of the Society, but it seems to be a subject of importance. These aberrations of light coming into the eye, which I have described, are common to all eyes. I have tested many persons on seeing radiating lines about the reflections from an automobile. You cannot drive a block in any city on a clear day without encountering them; and these reflections from the sun are bright enough to be seen by our ordinary light-adapted eyes. I have studied them in my own eyes preferably with an opaque disc, with three small holes drilled into it: one, 1 mm. in diameter; one, 0.5 mm. in diameter; and one, 0.25 mm. in diameter. I thus study the divergence of the rays from the point of light, when everything else is cut out by a black diaphragm. The 0.5-mm. diameter opening in this metal disc is, perhaps, the best one to work with. The 0.25-mm. diameter is somewhat small.

By this manner of examining my own eyes I have discovered a defect in each lens near the anterior pole. I have vision such as is ordinarily recorded 1.3 with

my correcting glasses—as good as I had when I was 30 years old, but I discovered a point of partial opacity. There is a brown partial opacity near the anterior pole of each lens. I have had my eyes examined with a corneal microscope by a colleague who could see the opacity in each lens. That is a clinical matter. I do not believe the opacity in my lenses is of much practical importance, but we can learn something about opacities of the lens by studying them on ourselves with a brilliant point of light, reflected from some surface. By shutting off the mass of light in general that is received on the retina from an object, we get a dark field in which are the radiating lines caused by reflection from the anterior pole of the lens near the center of the pupil. The radiating lines are best seen when the light is admitted as near as possible to the anterior pole of the lens.

ERYTHEMA NODOSUM WITH NODULES IN THE CONJUNCTIVAE

A CASE REPORT

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We have observed a patient with erythema nodosum complicated by nodular lesions in the conjunctiva of each eye. A search of the medical literature reveals few references to such an occurrence and, in view of this, it is thought worth while to report the case.

CASE REPORT

Mrs. E. E., an American housewife, aged 54 years, was first seen by one of us (M. W. P.) in September, 1935. At that time she complained of exhaustion. A thorough study revealed little except hypertrophic changes in the tonsils and injection of the pillars. Examination of the various systems was negative. Routine examination of the blood and urine revealed no abnormal findings. The blood Wassermann and Kahn tests were negative. A tonsillectomy was performed, following which she improved symptomatically.

Two months later the patient presented herself complaining of an inflamed condition of both eyes, of one weeks' duration. There was no discomfort connected with this condition and there was no pain produced by motion of the eyeballs in any direction. Though she had quickly recovered from the tonsillectomy, she stated that the right side of her throat had been sore for a few days. She also complained of some soreness in both knees. Examination of the eyes at that time (L. S. G.) yielded the following results: Vision in each eye, with myopic correction was 6/6. The corneae and irides were normal. The pupillary reactions and muscular balance were normal and the media were clear. On external examination there was no swelling nor thickening of the eyelids, and the tarsal conjunctivae were normal. Situated over the insertion of the four recti muscles in each eye there was a triangular, cherry-red area of hyperemic conjunctiva with its base at the limbus, spreading out fan-shaped as far back as the equator of the eyeballs. Under the slitlamp these areas presented a superficial wide-meshed network of vessels of a dark cherry-red hue, confined solely to the bulbar conjunctiva (fig. 1). The areas were freely movable over the sclerae, which were both normal in color and texture. Located at about the center of each of these areas were from two to four nodes the size of a small pinhead. Under high

power each node appeared to be situated in a slightly sangineous fluid through which could be seen a network of small vessels surrounding each node. One or two of the nodes showed slight staining by fluorescein. An intradermal tuberculin test was negative.

nodules and the erythema nodosum gradually disappeared, becoming completely absent approximately four weeks after their appearance. Fever coincidentally disappeared.

Eight weeks after the onset of the illness the patient had completely recovered.

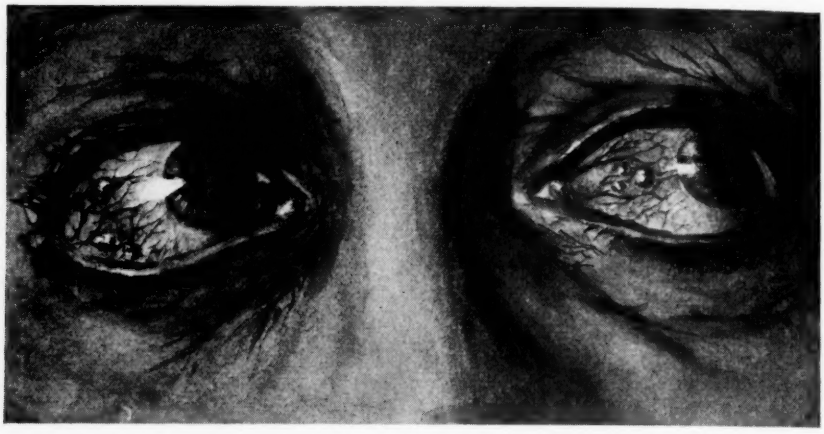

Fig. 1 (Greene and Perry). Erythema nodosum with nodules in the conjunctiva.

Five days later, for the first time, the patient was found to have slight elevation of her temperature. She complained of pains in the joints and general malaise. On examination the pharynx was diffusely reddened. There was slight swelling and pain on motion of the ankle, wrist, and knee joints. Over the extensor surfaces of the arms and legs below the elbows and knees were scattered the typical reddened nodules of erythema nodosum. She was given sodium salicylate (45 gr. daily) and advised to remain in bed. Hot throat gargles were prescribed.

One week later the arthralgia had improved. There was little change in the erythema nodosum and no change in the ocular nodules. For the next three weeks she continued to have low-grade joint pains and slight malaise. Her temperature showed daily elevations as high as 100°F.

Over this three-week period the ocular

She no longer complained of the joint pains and her temperature had remained normal. There had been no recurrence of the nodules in the skin or eyes. Throughout this entire time she had continued to take sodium salicylate.

She has been seen at intervals to date (July 1, 1938) and she has had no recurrence of the disease.

Comment

Reports of ocular nodules appearing concomitant with erythema nodosum have but rarely appeared in the foreign literature, and in so far as we can determine are absent from the American literature. Reis,[1] in 1906, and more recently Schieck,[2] have commented on the occasional appearance of a triangular nodular area in the eyes of persons with erythema nodosum. Beaudonnett,[3] Weltistscheff,[4] Rotth,[5] Rameev,[6] and Krachmalnikov[7] have each described one or more cases

of erythema nodosum with hyperemic and movable ocular nodules which appeared and disappeared together with the skin nodules. The similarity in these independently described cases is striking. Feigenbaum[8] has also reported four cases of erythema nodosum with ocular involvement, the author terming the unusual complication "metastatic furuncular episcleritis." The patient in one of these, a middle-aged person, in addition to the skin disease and a "florid episcleritic nodule" in the left eye, suffered with acute inflammatory disease of the joints. Involvement of the joints appeared in this patient together with that of the skin and eyes. All symptoms completely disappeared following the administration of salicylates. Carstein[9] has also reported a similar case, the patient being a middle-aged person who, in addition to erythema nodosum and "elevated reddened patches in the region of the limbus of both eyes," developed acute polyarthritis with the onset of the disease. These two cases seem nearly similar to the one described by us.

The nature of the ocular nodules, seen in these cases and in the one observed by us, is a question of considerable conjecture. Their physical characteristics seem not dissimilar from the characteristics of skin nodules. Both are of purplish-red color and movable. Their simultaneous appearance and disappearance seem significant. It seems reasonable to suppose, therefore, that the mode of production of the nodules in each location is of a related, if not identical, nature.

Summary

A case of erythema nodosum with nodules in the conjunctiva is reported.

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SHALL WE USE CYCLOPLEGICS?*

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Among ophthalmic physicians there has been a somewhat general agreement as to the desirability of using cycloplegia in the majority of refractive examinations. Some optometrists condemn cycloplegia, and present to the layman a dark picture of the dangers that accompany the instillation of cycloplegics. That such propaganda is purely selfish in character can hardly be doubted. Moreover, if the law were modified to allow optometrists to use cycloplegics, they would be the first to announce the advantages to be gained to their customers or patients, and would promptly avail themselves of such legal sanction.

There are a few ophthalmologists who, while they do not condemn the use of cycloplegia in refractive work, nevertheless consider the general use of cycloplegics unnecessary for even objectionable.

One may readily acknowledge that it is not absolutely necessary to resort to cycloplegia in every refractive examination, even in fairly young persons, although very few ophthalmologists venture to deny the necessity of employing cycloplegia in children of preschool age. The question is, would a general disposition to give up the use of cycloplegics in adults serve or disserve the public interest?

I have repeatedly asserted that no one can be regarded as an expert refractionist who could not make an approximately accurate measurement of the refractive error without cycloplegia in most of his patients. It is to be regretted that many medical refractionists do not make a careful analysis of the patient's refraction until the ciliary muscle has been paralyzed, and then base their measurements almost entirely upon the retinoscopic findings, supplementing these findings, at best, with a hurried and inadequate check-up of the corrected vision at the trial case.

Let us consider the three types of refractive error, two or all of which may, of course, be present in the same patient. Taking first myopia, it has often been stated, and with some degree of accuracy, that myopic errors can usually be estimated correctly without the aid of cycloplegia. This is perhaps truer of high amounts of myopia than of low amounts.

It is an important principle of refraction work that an eye that exhibits a small amount of error is more likely to suffer from eyestrain than one with a high error. It is too generally assumed that low as well as high myopic errors do not cause eyestrain. But I have repeatedly found symptoms of eyestrain in cases in which both eyes showed very low myopic errors, even when unaccompanied by astigmatism. The reason for this may be found in the tendency of patients with a moderate amount of myopia to attempt to improve vision by habitually squeezing the eyelids together. Such a habit may give rise to important mistakes or to uncertainty in the measurement of the refractive error. The use of cycloplegia tends to overcome this habit and so affords greater accuracy in making the refractive measurement. It should be remembered, too, that myopic eyes are often benefited by the rest that cycloplegia affords.

A further objection to the indiscriminate omission of cycloplegia in myopia consists in the fact that many patients

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have either an inequality of refractive error as between the two eyes or a combination of astigmatism with myopia, or both conditions. Any one of these combinations favors the development of a habit of straining the eyes or eyelids in an attempt to secure better vision, and in this way defeating the efforts of the examiner to discover the exact refractive error.

In regard to hyperopia, there is less tendency to deny the advantage or necessity of employing cycloplegia. I do not feel that the distinction is an entirely logical one or is altogether borne out by experience. In the majority of hyperopic cases a careful preliminary test without the aid of cycloplegia discloses either approximately the same amount of hyperopia as is subsequently determined with cycloplegia or within one fourth of a diopter of that amount of hyperopia. This is not to be understood as stating that I do not find significant differences under cycloplegia; such differences often appear in the form of altered measurement of the amount or axis of astigmatism. On the other hand, a fair number of cases of myopia will display one fourth of a diopter less myopia under cycloplegia than without it.

True, there are a few cases of hyperopia in which the error found under cycloplegia is much greater than that found without cycloplegia. These are the patients in whom the problem presents itself as to whether to give the full correction for the error found under cycloplegia; in other words, whether to face the possibility of having to climb down or that of climbing up from the amount of hyperopic prescription at first given.

My statement as to the large proportion of cases of hyperopia in which I find almost or quite as great an amount of hyperopia before as after the use of cycloplegia may arouse question or criticism. To obtain such results it is necessary to make thorough use of the fogging method and of the astigmatic dials or cross-cylinder tests, or of both; and, above all, to supplement the usual fogging technique with final fogging of both eyes simultaneously. It is well to remember that the patient will use his prescription for both eyes together instead of singly—a most important reason for ascertaining the amount of hyperopia as disclosed by fogging both eyes simultaneously.

Especially when we come to the measurement of astigmatism are we likely to find important differences between the correction without and that determined with cycloplegia. Without cycloplegia, careful estimation of strength and axis at the trial case may frequently lack definiteness or accuracy. It may be asserted that in such cases the examination without cycloplegia is sometimes more accurate than that made under cycloplegia. My own experience has occasionally, but by no means usually, borne out such an impression. In spite of the fact that the astigmatic error very often, or even usually, varies in different parts of the same pupil, there is good reason to suppose that for perfect vision the brain commonly selects a limited area of the pupil, whether or not the pupil is dilated. I believe that in most eyes this selected area remains approximately or precisely the same under all the varying diameters of the pupil, including the temporary marked dilatation under cycloplegia. The chief advantage of cycloplegia thus lies in relaxation of the ciliary muscle, rather than in the opportunity afforded for exact retinoscopy.

There are a few patients in whom the loss of time incident to the use of cycloplegia is an important factor, or in whom the prejudice against cycloplegia is insurmountable. The inconvenience is usually less than was anticipated, especially

as regards homatropine, and particularly if eserine is used to counteract the ciliary relaxation. Now and then, in cases in which it is found necessary to use hyoscine or atropine, I instruct the optician to supply a temporary supplemental pair of +2.50 diopter spherical lenses for close work.

In some adults who show special resistance to the use of cycloplegia, one may try the effect of using a 2-percent-cocaine solution a half hour before beginning the test, instructing the patient to keep his eyes closed during the interval. Many of our difficulties arise from habitual pressure by the eyelids in the patient's attempt to obtain clearer vision. In such cases a mild solution of cocaine is valuable for the increased palpebral opening which it produces, and for the associated relaxation of eyelid pressure. With Beach's combination of Benzedrine (amphetamine sulfate) solution with a reduced quantity of homatropine, my experience has been somewhat inconclusive.*

The argument as to the toxic effect of cycloplegics has very little weight. In this age of the use of the tonometer for measuring intraocular tension, no one should fall into the error of administering numerous doses of a cycloplegic to a patient with incipient glaucoma. In very doubtful incipient cases of glaucoma it may be an advantage to cause a rise of tension under homatropine, for in this way the diagnosis may be rendered more certain and the indication for therapeutic measures may be more definite.

As to the occasional case in which there is sensitiveness to homatropine, or even to other cycloplegics, this may be managed by observance of the rule to which I have called attention elsewhere; namely, that the cyclopiegic should be administered shortly after the ingestion of a meal. If this rule has not been observed, the tendency to nausea, unsteadiness, or other related symptoms may often be very readily overcome by having the patient take food immediately.

Except in cases in which we must face the alternative of either working without cycloplegia or abandoning the patient to his own devices, it seems to be much safer to make the use of cycloplegia a routine measure than to use it only exceptionally or not at all.

The general relaxation of eyes under cycloplegia seems often to be more complete several hours after administration of the cycloplegic (namely, at a time when the accommodation has partly returned) than within the first hour or so, when the loss of accommodation was at its height. This difference may be due partly to a cerebral reaction, the brain having more completely broken away from the constant attempt to obtain clear vision. Be this as it may, another examination several hours after the first under cycloplegia is often most useful in checking up doubtful details.

The question of how much of the difference between the precycloplegic and the cycloplegic test is to be prescribed must be decided by each ophthalmic physician according to his personal experience and predilection. To each one who is debating this question I would say: Be sure that you have used the fogging technique, including bilateral fogging, to its full possibilities. I should like further to urge the method of fogging even under cycloplegia, in order to avoid being misled by any fraction of unrelaxed accommodation.

Sometimes, after examining in succession several cases that show agreement between the precycloplegic and the cycloplegic test, I encounter a patient for whom, for some reason, I have prescribed lenses without cycloplegia, but in whom complaint leads to reëxamination under

* Further experience with such a combination, using 5-percent homatropine solution, has been on the whole very satisfactory.

cycloplegia, with marked change of correction and greatly increased satisfaction to the patient.

A recent interesting experience was the case of a highly intelligent schoolgirl, 15 years old, in whom I had used homatropine without getting much difference from the precycloplegic examination. The correction thus found gave some but not complete relief from eyestrain. The patient had a moderate compound myopic astigmatism. I subsequently resorted to hyoscine, 1:240, and found in the right eye 0.25 D., and in the left eye 0.37 D., more astigmatism, with slight modification of the axes. The change made the patient much more comfortable. Contrast such an experience with the statement made by Gjessing, about 10 years ago, to the effect that "the use of weak cylindric glasses, which in the United States of American is so 'modern,' is certainly in many cases entirely useless."

A second instructive case was that of a 64-year-old lawyer who, without a cycloplegic, and in spite of repeated careful tests, varied from 177 degrees to 5 degrees in statement of the axis of a −5.00 D. cylinder. Under homatropine, 2.5 percent, instilled six times the axis of this his only good eye gave a steady record at 180 degrees.

May I stress here that the advantages which might have been derived from the cycloplegic test are too often sacrificed through an exaggerated fear of the patient's inability to become accustomed to wearing any greater correction than that readily accepted by each eye at the postcycloplegic test. Some refractionists never prescribe a full correction for the amount of hyperopia found under cycloplegia, and I have even seen a hyperopic converted into a myopic prescription, the result of a hurried postcycloplegic test.

Courage as well as understanding on the part of the refractionist is necessary. Too many workers fear the struggle with a reluctant patient. In children the intelligent coöperation of the parents is essential and is not always easily secured. It should not be forgotten that the patient's most difficult time is likely to be just when the effect of the cycloplegic drug is wearing off, for at that time the accommodative power has been only partly restored, and the strain placed upon this incomplete power of accommodation is particularly apt to set up a spasm which blurs distant vision. The final conclusion as to the practicability of a full correction should not be arrived at until after the glasses have been worn constantly over a prolonged period.

Some of the grossest refractive mistakes are committed in dealing with cases of strabismus. If a full correction as found under cycloplegia is ever necessary, it is in the case of convergent strabismus. The correction here prescribed should be precisely that found for each eye, regardless of the presence of amblyopia in one eye. It is altogther illogical to correct fully the amblyopic eye, and at the same time to undercorrect the better eye; or, on the other hand, to correct fully the amblyopic eye while overcorrecting the seeing eye, in the hope of making the two eyes see equally. Both eyes should be corrected on the principle of making them emmetropic in optical construction in combination with the correcting lenses, and by no means on the false principle of giving them both equally poor vision with correction. Only by such artificially produced emmetropia can the brain be given opportunity to coördinate upon the basis of the accommodative effort required.

I do not believe that we can afford to neglect the advantages to be derived from the use of cycloplegia, although in case of necessity we should be competent to make a noncycloplegic examination with the greatest possible accuracy.

530 Metropolitan Building.

Discussion

Dr. George F. Libby, San Diego, California: Dr. Crisp has given an excellent paper. I want to mention one point that we both learned from Dr. Edward Jackson; that is, in using homatropine to obtain cycloplegia it has been the custom of all three of us to use a 3-percent solution, warmed to about body temperature, and applied by raising the upper lid and putting a drop at the upper margin of the cornea. Dr. Jackson believes—and I am inclined to agree with him—that we secure better absorption by putting homatropine at the upper edge of the cornea, and holding the upper lid until the solution trickles down over the corneal surface. It has been our custom to instil one drop in each eye every five minutes until six drops have been instilled into each eye. By that method we feel that we obtain complete and satisfactory cycloplegia.

I want to mention one other point that the late Dr. Robert L. Randolph advocated, that is, the instillation of a drop of 0.25-percent solution of eserine after each refraction under cycloplegia. It gives the patient comfort and reassurance, and removes any element of danger from the cycloplegic.

Dr. W. B. Lancaster, Boston: I agree with Dr. Crisp that there is a too general adoption of the belief that cycloplegia should be used in almost all cases, especially in children, and I should like to adduce some additional arguments in favor of omitting cycloplegia in many cases.

What do we use cycloplegia for? We use it to control accommodation. Why do we wish to control accommodation? Because accommodation, by contraction and relaxation of the ciliary muscle, changes the refraction which we are trying to measure, increases myopia, and decreases hypermetropia. For instance (I am going through the A B C's to start with), suppose a patient at the age of 20 is examined without a cycloplegic and we find in the right eye +2 D. with vision 6/5, and in the left eye +2 D. with vision 6/5, and, testing both eyes together, +3 D. with vision 6/5. If we gave a cycloplegic, perhaps we might obtain a vision of 6/5 with four diopters. What difference would that make in your treatment? You certainly would not give four diopters correction in a patient 20 years of age who had never worn glasses. One would give somewhere between two and three diopters, according to various conditions that the case might present, so that in this case cycloplegia has not given any help.

You would perhaps retort, "Yes, it has given me a good deal of help because it has shown me that there is no astigmatism." How does accommodation affect astigmatism? The best book in German on accommodation and refraction is the one by von Hess. He states that accommodation is not capable of producing astigmatic change in the lens so as to correct an astigmatism. Duke-Elder, who has written the best textbook in English, is of the same opinion. Accommodation —contraction of the ciliary muscle—does not produce an astigmatic change in the lens so that it can correct existing astigmatism. Luedde, who, perhaps, has given more attention to this subject than any one else in this country, is very positive in this regard. We know that accommodation can neutralize astigmatism in some cases, but it does not do this by an unequal contraction of the ciliary muscle producing an astigmatism of the lens which corrects an existing astigmatism. It simply moves the whole conoid forward or back so that different portions of it fall on the retina. If the interfocal circle falls on the retina, then all the lines will

be equally distinct or equally slightly blurred, but accommodation does not neutralize the astigmatism by an unequal contraction of the ciliary muscle. If it did, it would be easy to determine the fact. I reported a case before this Society about 20 years ago in which I did measure this, or rather, in which Souter measured it for me, but that was a very unusual case—a case of paralysis of the third nerve.

Dr. Harry S. Gradle, Chicago: May I take the liberty of differing with some statements that Dr. Lancaster has made as regards the lack of necessity for the use of cycloplegics in the majority of cases? Patients come to the ophthalmologist for the last word regarding their eyes. It is true that a large percentage of them can be refracted adequately without cycloplegia, but it is equally true that no eye can be examined thoroughly without the use of a cycloplegic. I believe that it is necessary for the ophthalmologist to know more about any eye that comes to him than any general or nonmedical practitioner can know about such an eye; and, secondly, it is necessary not only for that individual eye, but also as a preventive against future trouble, to use cycloplegia. A large percentage of blindness could be prevented by the early use of cycloplegia, particularly in the early detection of glaucoma. I do not believe that the American Ophthalmological Society should go on record as opposing the routine use of cycloplegia for the examination of the eyes.

Dr. Edward Jackson, Denver: The question of whether or not to use cycloplegics depends on whether we want to know all that we can know about the eye for which we are prescribing; or whether we are content to follow certain rules that have been laid down for us, without ascertaining what conditions might be disclosed about this particular eye or this particular patient. We can always learn more by the use of cycloplegics than we can learn without them.

The use or the nonuse of cycloplegia often depends on the patient's resistance to its employment. We should know certain things and consider them with reference to the eye under cycloplegia. A partial correction is not a correction of the error of refraction. Every patient with a partial correction of myopia that I have seen supplemented this partial correction by looking obliquely through his lens. In this way he obtained the effect of a stronger lens, but often at the cost of inducing astigmatism, which was against the comfortable use of his eyes. Patients, however, learn this trick in order to see better, and avail themselves of it. The same effect of looking obliquely through the lens is responsible for a large part of the dissatisfaction of the hyperopic who are given a full correction. When they gaze obliquely through the lens, they have an overcorrection. If we know all that we can know about the case, we can consider these things and are in a better position to reach a sound judgment as to what glasses are needed and how constantly they should be worn.

One other point is overlooked. Every one probably is able completely to relax his accommodation when he falls asleep. He can learn—and I have had this fully illustrated by many cases—to relax accommodation completely and see through his glasses more quickly than he can learn to use a lesser amount of accommodation and see clearly through partially correcting glasses. For patients in general an unaccustomed partial accommodation is more difficult than complete relaxation. Patients often endeavor to become accustomed to a partial correction, but are unable to see with the lenses after months of trial. When the full correction is given, however, with a little caution as to look-

ing through the center of the glasses, they will return in a few weeks to report that the lenses are satisfactory. Most persons can relax accommodation when they go to sleep, and it is easier for them to learn to relax accommodation and see clearly with the full correction, than to relax partially and see clearly with a partial correction.

Dr. W. H. Crisp, closing: As regards Dr. Lancaster's comment on the patient who is supposed to show two diopters of hyperopia, taking each eye separately, and three with both eyes together, and four with cycloplegia, and Dr. Lancaster's statement that we should certainly not give him four diopters, I would say that I most certainly should, after I had warned him that he might have difficulty in learning to use the full correction. A patient came to me who had never worn glasses. Under cycloplegia he accepted +5.50 D. spheres at the trial-case. I did not want to make it too difficult for him, so I deducted a half-diopter and gave him +5.00 D. spheres. I told him he might have trouble in becoming accustomed to the lenses. Three months later he returned complaining of some residual discomfort. I tested him at the trial-case and he accepted +5.50 D. spheres again, so I gave him an extra quarter-diopter which brought comfort. To another patient who had worn +0.75 D. spheres I gave +1.25 D. or +1.50 D., and he was more dissatisfied than the patient who was given five diopters. You cannot tell until the patient tries, and surprises occur all the time. There are children who take a one-diopter plus sphere and who, in spite of all the efforts of the parents to have them wear the glasses constantly, still show a definite blurring in reading the test letters after wearing the glasses for some time. We must decide for the individual case, but we are not giving the patient a fair chance unless we endeavor to have him wear the full correction.

Can accommodation correct astigmatism? It has been stated that it cannot. I do not know of anything that has been done to prove that accommodation cannot correct astigmatism. I do not believe that if you have a half diopter of astigmatism the accommodation is capable of correcting it; but suppose that by action of one part of the ciliary body the accommodative action can alter the astigmatism by only a quarter or even an eighth of a diopter—that patient is going to experience eyestrain. Even though the involuntary effort can only go one eighth of a diopter toward correcting the astigmatism, the patient may experience trouble from making this constant effort, and I am sure many eyes do undergo some such change part of the time. We must also consider the action of the eyelids in correcting astigmatism.

As to the use of eserine: here and there I find someone who uses not merely one drop of eserine, 1:240 solution, but two drops of eserine of that strength. I have instilled two drops, and some patients had a very uncomfortable time, so in the case of most adults and adolescents I merely use one drop after homatropine.

A GLARELESS ILLUMINATED HOLDER FOR VISUAL-ACUITY TEST CHARTS WITH VARIABLE INTENSITY OF LIGHT*

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At various times we have been requested by members of state, municipal, and college health departments to give some attention to equipment for testing vision in the schools and for similar purposes. In particular we have been asked to try to devise an inexpensive, easily portable chart holder that would be completely glareless and would provide a glareless, well-distributed, even illumination of the test chart of a correct and standard intensity. It is our purpose in this paper to describe such a chart holder.

There are, in our judgment, the following needs for a careful selection of an equipment for testing vision in the public schools. (1) Customarily in school testing no attempt is made at a complete refractive correction. The test of vision must be depended upon entirely to indicate the condition of the pupil's eyes, to detect whether the condition is getting worse or better in case there is a refractive defect, and to decide whether there is need of reference for a medical examination. There is a poor chance to accomplish a satisfactory result if the conditions of making the test are not standardized and uniform from time to time and from place to place. For example, we find there is great uncertainty at the present time as to just what is normal acuity for children at different ages. The feeling of uncertainty is due to the fact that it is well known that the conditions of making the test are not the same from time to time and from place to place in examining the same child. Also, if the test conditions are not satisfactorily standardized, one cannot tell in examining the child in different years of his school life whether his condition is the same, better, or worse. From this it can readily be seen that careful attention to consistency in vision testing is more important in the schools than it is to the doctor in his routine practice. That is, the doctor is prepared to make a complete refraction and does not, therefore, have to depend so much upon the standardization of his conditions for testing and rating vision. Further, the refractionist's job is to give the best vision it is possible to obtain by means of a correcting glass providing there are no auxiliary reasons for prescribing otherwise, and in consequence he is not so dependent on what is accepted as the normal rating of vision nor on any previous rating he has made. (2) There is a great deal of practical and scientific need for knowing what vision is at different ages and what should be considered the norms of vision at these ages, particularly during the formative period and beyond middle life. In this we are personally very much interested, and it is one of our strongest motives for trying to secure standardized and correct test equipment. Very important means of obtaining a part of this knowledge are the examinations that are made systematically in the schools—grade, high school, and college.

The two most important variable factors in vision testing are (a) type of test chart used and lack of uniformity in these charts, and (b) intensity of illumination of the chart and its wide variation from place to place and time to time. Of these the more important is intensity of illumination. Apparently the testing from the kindergarten through college is in a

*From the Research Laboratory of Physiological Optics.

very unfavorable condition. A great variety of test equipment is being used, and very little attention is paid to the standardization of the illumination of the test charts. Results obtained under these conditions are, of course, of little value from the standpoint of comparative ratings or the determination of anything approximating a set of norms.

The lighting device which is used on our chart holder consists essentially of two boxes of special construction and of suitable location in relation to the surface to be illuminated. It was planned for three purposes: for the illumination of pulpits and speakers' desks, for the illumination of test charts, and for the illumination of music racks. It is the application to test charts alone that will be discussed in this paper. This application is shown in figure 1.

In figure 1 are given (a) an outline drawing of the chart holder showing the location of the lighting boxes and their relationship to the surface to be illuminated, (b) a drawing showing a cross section of the chart holder, and (c) a drawing showing a set of the vanes or glare baffles on the inner side of each lighting box. In figure 2 are shown larger lighting boxes of the same type built into a portable unit for use on lecture tables and speakers' desks.

Some of the faults in the present illuminated chart holders are: excessive glare from the lighting device; glare on the surface of the chart; a very uneven and poorly diffused illumination on the test surface; high light and brightness on the lateral edges of the chart and near to the illuminating units; an unstandardized and a too high intensity of light; and lack of portability.

Our chartholder has been especially designed to correct all of these faults. This has been accomplished in the following ways:

(1) The eyes are shielded from glare from the lighting units by vanes or glare baffles, properly inclined, on the inner side of each lighting box. Further to complete the glare protection, both surfaces of these vanes are surfaced in flat black.

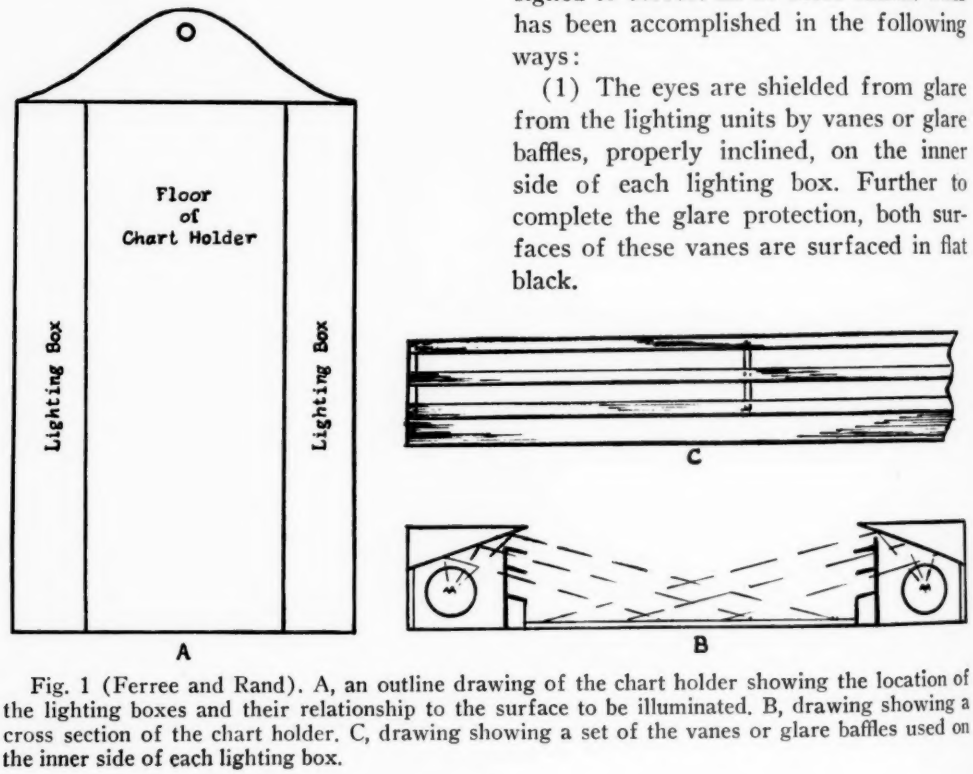

Fig. 1 (Ferree and Rand). A, an outline drawing of the chart holder showing the location of the lighting boxes and their relationship to the surface to be illuminated. B, drawing showing a cross section of the chart holder. C, drawing showing a set of the vanes or glare baffles used on the inner side of each lighting box.

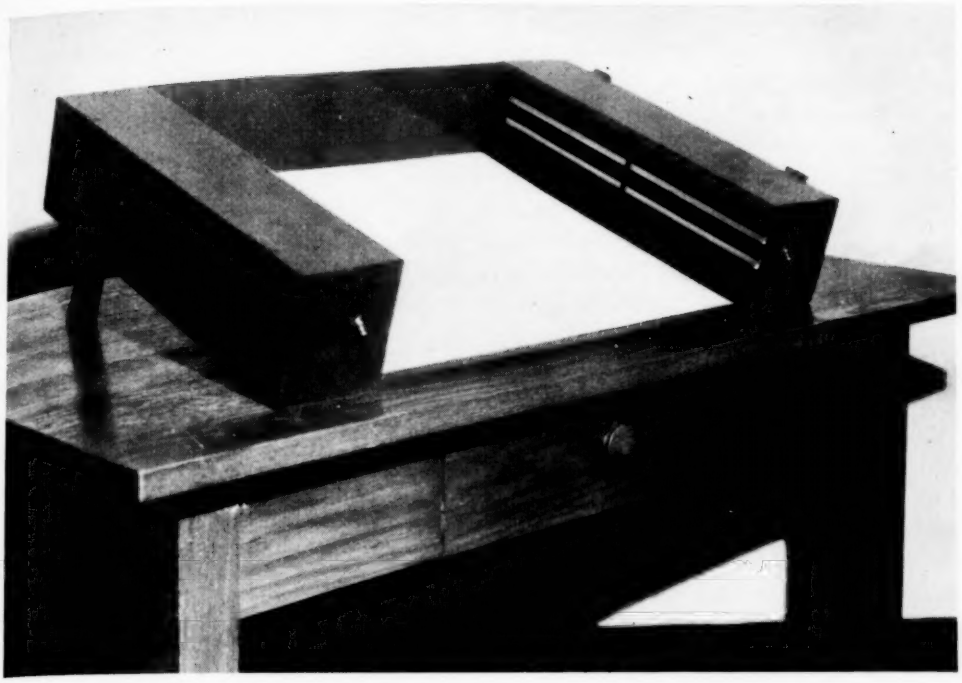

Fig. 2 (Ferree and Rand). Large lighting boxes of the same type as are shown in figure 1, built into a portable unit for use on lecture tables and speakers' desks.

(2) Diffusion of the light is secured by placing behind the vanes a plate of diffusing glassware, probably Celestialite glass, because this glassware not only gives excellent diffusion of the light but also all the color correction that would be needed. It is a comparatively thin plate, light in weight, made of 3-ply glass, the two outer plies of opal glass and the intermediate ply of blue glass. An etched plate of Daylight glass could be used, but this would be expensive.

Diffusion of the light is, of course, a very important factor in securing evenness of illumination of every part of the chart and of the floor of the chart holder. By minimizing specular reflection, this diffusion is also an important factor in eliminating glare from the test surface. The elimination of glare is further effected by the direction of light, so that none of the specularly reflected rays can enter the eye. A still further benefit along this line can be obtained by covering the floor of the chart holder with white blotting paper or other mat material. This would be of service in cases in which the chart is not so broad as the floor of the chart holder. Diffusion, too, gives high visibility to the test objects themselves. For clear vision, light from every point in the object must be brought to a focus in the image formed on the retina. For this to take place, every point in the object must be adequately illuminated. Adequate illumination for each point is secured only with well-diffused light. Finally, the diffusion of the light serves to eliminate all shadows that might otherwise be cast by the inclined vanes.

(3) High light and high brightness on the floor of the chart holder near the two lighting boxes are prevented by a thin strip of metal of suitable breadth walling

off the luminous aperture up to the lowest vane. Thus the right side of the chart holder will receive its illumination chiefly from the lighting box on the left, and the left side will receive its illumination chiefly from the lighting box on the right. In the experimental model of the device, the vanes should be made adjustable in order to ascertain the exact angle of inclination at which they should be set to secure both glare protection and the proper direction or placement of the light. Direction of the light is further aided by an inclined, diffusely reflecting plate of Alcoa aluminum mounted at a suitable angle above and behind the lamps.

(4) In manufacturing the lighting boxes, the standardization of intensity can be secured through a careful selection, seasoning, and location of the lamps employed* and the use of diffusing glassware of the needed density. In this latter connection more than one plate of glassware may be used, the plates having the same or different densities, as may be required. The manufacturer has, of course, to see to it that this standardization is secured in all chart holders that are put on the market.

(5) Easy portability can be had by making the chart holder of thin, hard-sheet aluminum and using care in the selection of other material and in the construction to keep the weight down.

The holder should be made so that any standard chart can be used. The chart which we have recommended, however, as especially suited for the correct and reproducible testing and rating of vision is the double-broken circle chart described in a former paper.[1] In a later model the test objects have been rearranged so that all the sizes can be included, with a sufficient number of each size, in a chart 10 by 28 inches.

The feature of variable illumination can be added, if desired, with very little change of construction. One of the advantages of adding this feature is the ease it would afford for securing the intensity that is chosen as standard. This advantage alone might render the construction of the holder less expensive than would be the case if the standard intensity had to be secured by the means noted in (4) above. The following change in the construction is all that would be required. An inside wall of thin aluminum could be added next to the diffusing plate. At a suitable height in this wall a longitudinal slot or aperture could be cut of suitable breadth and of a length almost equal to that of the boxing. In this aperture would be inserted a single vane of thin aluminum mounted along its central axis on a slender rod, the ends of which pass through the top and bottom of the boxing. On the upper end of this rod will be mounted a button by means of which the vane can be rotated. As the vane is rotated from a position normal to the diffusing plate to the parallel position, the intensity of light is varied from full to approximately zero. A good diffusing plate such as Celestialite glass will be quite sufficient to eliminate the shadow cast by the vane. With this construction it is quite probable that fewer glare baffles would be needed to shield the eye from the brightness of the diffusing plate, inasmuch as a smaller part of the plate is illuminated to a brightness. Perhaps, indeed, only one glare baffle would be needed.

An intensity scale can be provided as follows. On the top of the boxing may be mounted in upright position an arc-shaped rim of metal on the front surface of which graduations are marked. Beneath these graduations a slot is cut to

* Best results can be obtained with tubular lamps. These lamps are readily available in suitable lengths and wattages.

receive a pointer that is attached to the rod supporting the rotating vane. At the front end this pointer is bent upward to indicate the graduations on the scale. So positioned, the scale can easily be read by the examiner.

The holder should not be expensive to make. If light-weight aluminum is used and care taken throughout in the selection of the auxiliary material, the weight should not be more than 5 to 10 pounds.

With respect to the cardinal requirements: correctness of illumination, easy portability, and moderate cost, the holder will, we believe, give a high degree of satisfaction.

There is an important use of such a chart holder by refractionists. By preference many refractionists still use and always will use a printed chart. We do not hesitate to say that in our opinion and experience the best test conditions, particularly for visual acuity, are given by a properly illuminated printed chart. With it, a better state of adaptation may be had, a clearer definition of the test object, a better diffusion of light and a better background for seeing the test object than can be had by any other type of test equipment. Provided with the feature of variable illumination, ideal conditions for testing vision and for detecting and correcting errors of refraction are obtained with the printed chart.

In this latter connection the very great importance of making the test at low illumination will be remembered.[2] The refractionist who uses medium or high intensities of illumination for detecting errors of refraction is working against himself. By giving greater power to discriminate detail, the higher illumination enables the test object to be seen even when its image is blurred. It is not hard, for example, to convince a presbyopic subject with blurred images for near seeing, what the effect of high illumination is on the clearing up of blurred images or, conversely, how impossible it is to see the details of near objects at low illumination. Obviously, then, when one wishes to detect small defects in the image or to decide which of two correcting glasses gives the better result, a low illumination should be used. This is particularly important in case of astigmatism when one is trying to decide what is the proper strength of correcting cylinder and the best placement of its axis.

The use of intensity of light in refraction is just the reverse of what it is in lighting. In lighting, intensity is used to compensate for errors in the formation of the image; in testing and correcting for errors in refraction, it is used in a way that will most clearly reveal these defects. In earlier days there was great confusion on these points. In refraction, as well as in lighting, the tendency was to use high intensity of light and to give the clearest vision of the test object. Happily, today we know that this is not the correct procedure.

This chart holder would also be of a great deal of service in all places or stations in which there is a problem of the accurate and reproducible testing of visual acuity; such, for example, as in motor-vehicle departments, in the testing of railroad employees, in the air service of the Army and Navy, and in the commercial air service. In all cases where there is a need of a standardized requirement of service, there is a corresponding need of a standard testing of fitness for that service.

Perhaps the most widely used test of human powers is that of acuity of vision. In proportion as it is widely used there is need to provide a foolproof equipment. As the situation now is, the testing of vision is one of the most loosely conducted tests we have. Not only has there been no substantial change in the princi-

ples and procedure of making the test since the days of Snellen, but even the principles laid down by him are not complied with in a very great part of the testing that is now being done. So far as restriction or supervision is concerned, almost any type of test chart may be used under any type or intensity of illumination. The variable difficulty of task to which the eye may be subjected under these conditions of testing is a sufficient guarantee that consistency of result will not be obtained in testing the same person at different times and in different places, and that the test will not serve the important purpose for which it is intended.

With respect to type of test chart, it may be noted that capital-letter charts are sold and used without difference or distinction, some having letters constructed to meet the 1 to 5-minute requirement of the Snellen rating scale and others not meeting this requirement even when manufactured and sold by the same firm. Moreover, letters of the same size selected for use as test objects may in the different charts of each of these types, set a very greatly different discriminative task for the eye. Inaccuracies in the dimensions of the letters used are also of frequent occurrence. In former papers[1, 3] all of these matters have been discussed by us in considerable detail. We have discussed among other things the nature and principles of the visual-acuity test and what it should accomplish; the effect of type of judgment on the results of the test; comparative merits of different test objects, pointing out in particular the futility of trying to standardize the capital letters as test objects or to make of them a correct rating scale; the effect of intensity and composition of light on the results of the test; factors influencing the sensitivity of the test; and comparative merits of different ways of securing the test field.

Obviously the first step in reforming a bad practice is to provide test equipment that so far as possible will not permit of this practice and to make this equipment easily available to the public. It is with this purpose in mind that we have described in former papers, as already indicated, a test object and test chart that will give a correct and reproducible measure of the eye's power to discriminate detail, and in this paper an inexpensive chart holder which will provide proper conditions of illumination and will be easy and convenient to use in a wide variety of test situations.

Summary

Some of the faults in the present illuminated chart holders are: excessive glare from the lighting device; glare on the surface of the chart; a very uneven and poorly diffused illumination on the test surface; high light and brightness on the lateral edges of the chart and near to the illuminating units; an unstandardized and a too high intensity of light; and lack of portability.

The chart holder described in this paper was devised to remedy these defects. A simple mechanical provision is also made for varying the intensity of illumination in continuous change from approximately zero to full without change in the color, composition, or placement of the light.

The following are some of the situations in which there is an important need for such a chart holder. (a) In all cases where there is a problem of the accurate and reproducible testing of visual acuity; such, for example, as in motor-vehicle departments, in the testing of railroad employees, in the air service of the Army and Navy, and in the commercial air service. A particular and very important case of this need is in the testing of vision in the public schools, where customarily

no attempt is made at a complete refractive correction and all knowledge of the pupil's eyes and all advances or recessions of any condition, refractive or otherwise, is dependent upon the testing of vision. Apparently this testing from the kindergarten through college is in a very unfavorable condition. A great variety of test equipment is being used and very little attention is paid to the standardization of the illumination of the test charts. Results obtained under these conditions are of little value from the standpoint of comparative ratings or the determination of anything approximating a set of norms. (b) In the correction of errors of refraction. By preference many refractionists still use and always will use a printed chart. The best test conditions, particularly for visual acuity, are given by a properly illuminated printed chart. With it, a better state of adaptation may be had, a clearer definition of the test object, a better diffusion of light, and a better background for seeing the test object than can be had by any other type of test equipment. Provided with the feature of variable illumination, ideal conditions for testing vision and for detecting and correcting errors of refraction are obtained with the printed chart.

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THE PRACTICAL MEASUREMENT OF ACCOMMODATION AND CONVERGENCE

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The measurement of accommodation and convergence need not be time consuming nor fatiguing to the patient in the performance of routine refractions.

To be guided by an accurate determination of the amounts of muscle function in constant use, their maximum functions, their reserve power, and their relationship to one another is by far more important than to regulate modification of the refractive correction by considering the position of rest alone.

An instrument, partially described in a previous communication,* has been devised to facilitate the measurement of the following functions in routine practice:

- Interpupillary distance
- Accommodation: expressed in diopters and read directly
  - Maximum: monocular and binocular
  - Amount in use at work distance
  - Range
  - Region
  - Relative: positive and negative elements, at any specified near-work distance
  - Reserve
  - Comparison of the near add requirement to accomplish equality in presbyopic subjects
- Convergence: expressed in meter-angle terms and read from chart
  - Maximum
  - Amount required at work distance
  - Amount required at near point of convergence and accommodation
  - Amount required at any near point
  - Reserve at work distance or any near-work distance
  - Amplitude
  - Comparison of accommodation in diopters and convergence in meter angles:
    - Maximum
    - Relative, at work distance or any near point
    - Reserve

APPARATUS

Three parallel rails, calibrated in diopters and marked in centimeters, are mounted upon a tiltable-beam unit and are adjustable in all directions. Lens cells and carriers for various indicia are mounted upon and are movable on the upper parallel rails. The instrument has been described and illustrated in the reference.

TESTS

Interpupillary distance: The lens carriers are set before the eyes at the mark "O" on the scales. The plano lenses with bisecting scratch marks are then inserted into the lens cells. Sighting from the ends of, and along the rail at the eye being tested (each is done separately), the centers of the lenses are made to coincide with the center of the pupils by raising or lowering the scales and bringing them in or out. The removable plate is then put in place, resting upon the upper surfaces of the rails with the spirit-level side toward the nose piece, the lens carriers having been moved along the scales a very short distance to permit placing the plate between them on the nose-piece. The lens carriers are placed in contact with the plate. Sighting through the upper open grooves, the interpupillary distance is

* Martin, H. G. Amer. Jour. Ophth., 1938, v. 21, Feb., p. 161.

read off in millimeters. The plate is then placed at the other end of the scale just in front of, and in contact with, the card carriers, and the scales are brought in or out, raised or lowered, to correspond with the pupillary distance. The plate is then removed.

Accommodation

Maximum Accommodation

Monocular. With one eye occluded, the patient is instructed to fix the gaze upon the test type on the card, which is placed well out along the scale. The examiner then slides the card carrier slowly along the rail toward the eye until the point is reached where the patient can no longer read the test type and the reading on the scale is taken in diopters. The opposite eye is then tested in the same manner. This is, of course, an application of the Prince-rule method. These tests are made without and then with the proposed correction in the lens cells. Referring to any of the textbook charts comparison with age normals can be made. Any difference between the case reading and that of the age-group normal represents in diopters the spherical strength necessary to bring the patient's maximum accommodation to the normal.

To determine the amount of accommodation required at any specified near-work distance in centimeters, the card carrier is moved to that point on the scale and the dioptric reading recorded. This reading is expressive of the dioptric spherical-lens strength at the specified distance normally required, or the amount of accommodation in diopters used by the emmetropic eye at this point. The binocular function will be considered later on.

Range and Region of Accommodation

The card carrier is placed at the extreme end of the scale and is then moved slowly toward the eye until the test type is just readable, and this point is read off on the scale. Continuing to move the card carrier toward the eye from this point, the operator notes the point at which clear vision of the test type ceases. The difference between the two readings shows the range and also establishes the region of accommodation. In presbyopia and high degrees of hyperopia this is especially important, and that lens is given which permits of the greatest range or which provides the desired region. This test guards against overcorrection in presbyopia.

Relative Accommodation

These tests determine the maximum amount of accommodative effort that the eye can exert, and the maximum ability of accommodative relaxation at any specified distance. The former is spoken of as the positive, and the latter the negative element. Positive and negative relative accommodation can be tested at any specified near point within normal or corrected accommodative range by means of the instrument.

Negative Relative Accommodation

Each eye is tested separately. The card carrier is placed at the distance from the eye at which the determination of this function is to be made. A known plus spherical lens sufficiently great to blur the test types decidedly is inserted in the lens carrier before the eye to be tested. The examiner then moves the lens carrier along the scale slowly away from the eye and toward the test card to the point where the patient is just able to read the types, where the motion is halted and the dioptric reading taken. The test is repeated with the starting position of the lens well away from the eye and where the type is clearly readable. The lens carrier is then moved toward the eye until the indicia are no longer readable and the dioptric reading again is taken.

This is to check the former reading. The dioptric lens strength is subtracted from this scale reading and the remainder, expressed in diopters, is the amount of accommodative relaxation possible for the eye at this distance. It is, of course, necessary to correct for the amount of accommodation normally in use at this same distance. This can be read off on the scale at the point at which the card carrier is placed, and this reading is subtracted from the remainder just determined and expresses the *negative relative accommodation* at this specified distance.

Positive Relative Accommodation

Replacing the plus lens in the carrier with a minus lens of sufficient strength to blur the type, the test is conducted in the same way, by moving the carrier toward the test indicia until the type becomes readable, when the dioptric reading is again taken. The dioptric lens strength is subtracted from the scale reading; the remainder expresses in diopters the greatest amount of accommodative exertion possible for the eye at this distance. Correction is again made for the normal amount of accommodation in use at this distance, but this figure is added to the remainder just determined and the result is the *positive relative accommodation* for this specified distance.

Example: Let us suppose that the relative accommodation is to be determined for a distance of 33 centimeters.

Place the card carrier at the 33-centimeter mark on the scale. To test negative relative accommodation, place a 5-diopter sphere in the lens carrier, and slowly move the carrier away from the eye to a point where the type just becomes readable. Suppose this occurs at 11 centimeters, or 9 diopters on the scale. Subtract the lens strength, 5 diopters from 9 diopters. Four diopters, then, represents the greatest amount of accommodative relaxation for 33 centimeters' distance. However, the normal amount of accommodation in use at this distance is found by reading the dioptric scale where the test card has been placed, in this case, 3 diopters. Subtracting this reading of 3 diopters from 4 diopters just determined, leaves 1 diopter, which is the negative relative accommodation.

To test positive relative accommodation, replace the plus lens with a minus-5-diopter sphere, moving it away from the eye until the type is clearly readable. Suppose this point is represented by 6.6 diopters on the scale. The difference between the dioptric lens strength, 5 diopters, and this reading of 6.6 diopters, leaves 1.6 diopters, which represents the greatest amount of accommodative exertion at this distance. Since the normal amount of accommodation in use at this distance is 3 diopters, this figure must be added to the remainder just obtained and the resultant, 4.6 diopters, expresses the positive relative accommodation.

The amplitude of accommodation is then also apparent for this distance.

To insure comfort, the positive must at least equal the negative element at the near-work distance.

This test is made first without and then with the proposed refractive correction. Indication is given for modification of the correcting lens to insure comfort.

The measurement of relaxation or exertion of accommodation at a specified near distance as tested by the method offered here, involves really the *continuous* exertion or relaxation of accommodation to the greatest extent. This effect was found to be more expressive of the actual limitations of these functions, inasmuch as the interchange of lenses of successive strengths, as commonly used, permits of a return to a previous lower

state of activity during these exchanges, often resulting in a fatigue reaction or a stopping-short of the limit of function. Again, if too high a lens strength is used initially, or if the progressive increases are too abrupt, a false end point is often taken as true. For instance, if a patient is able to overcome plus lenses until 4 diopters is reached, it will be found that if an initial lens of 3 diopters is used, the patient fails to overcome this strength even though the limit is actually higher. The method offered here has the advantage of imposing a constantly increasing load uninterruptedly.

The amount of accommodation in constant use, or the amount required at the patient's working distance, can be determined by placing the card carrier at the work distance, and reading this measurement in diopters from the scale. Having tested the maximum amount of accommodation of which the patient is capable, and comparing that figure with the amount of accommodation in constant use at the work distance, the amount of reserve accommodation is apparent. If the amount of accommodation in constant use approaches too closely to the maximum amount of which the patient is capable, the reserve is insufficient and symptoms of discomfort will appear. The existence of accommodative insufficiency or excess are brought out by these tests.

An important test in presbyopia consists in determining the far point of accommodation with the correcting lenses in place, each eye being tested separately. Reference is made, of course, to the farthest point of near-vision range, which should be nearly equal for the two eyes to preserve maximum comfort.

An interesting and important phase of accommodative function, especially in presbyopic eyes, is the measurement of the

Binocular Near Point of Accommodation

The card carriers are removed from the upper scales and, with both eyes uncovered, the patient is directed to fixate the test indicia on the card carrier on the lower and middle rail. This card is slowly advanced from a far position toward the eyes by means of turning the thumb screw on the side of the tubular unit. When the point is reached where the type is no longer readable, the dioptric reading is taken from the upper scale.

In young patients the monocular and binocular near points of accommodation are very nearly the same, but in presbyopic subjects, tested with the near refractive correction in place, the binocular near point of accommodation is definitely and consistently greater than the monocular. The monocular test is made with the visual axes parallel, but the binocular test involves convergence, so we may conclude that the convergence stimulus might account for the greater binocular near-accommodative power. The suggestion is offered that if the binocular near point of accommodation is greater (nearer) than the near point of convergence, there is alternate fixation, which may be too rapid to be observed grossly. The monocular near point is influenced by the state of pupillary contraction, of course, as evidenced by the increased near point when the pin-hole disc is used. For practical purposes, however, the state of the pupil as it obtains in the case under test and at the distance tested is really the guide for the establishment of functional power.

It has been noted in young patients that if the binocular is greater than the monocular near point of accommodation, the condition simulates that of presbyopia, and the positive relative accommodation is generally found to be low.

An increase of .50 diopter sphere or more addition, for near, results in a

greater monocular near point of accommodation; but the binocular is not necessarily increased, although the near point of convergence may be. In many cases, therefore, the binocular near point, with correction, is more important than the monocular reading in consideration of the convergence factor.

In cases of a degree of convergence insufficiency, the near addition which provides a seemingly insufficient monocular near point of accommodation will generally be found to give an adequate binocular near point of accommodation with complete comfort to the patient.

Regional Accommodative Amplitude

Since the term "relative accommodation" is considered by some to mean the relationship between accommodation and convergence for specific distances, the term "regional accommodative amplitude" is perhaps more descriptive, and comments refer to what has been called "relative accommodation" in this paper.

Binocular Relative Accommodation (or binocular regional accommodative amplitude)

With both eyes uncovered, the patient is directed to fixate the indicia on the middle scale card, which is placed at the same mark on the scale at which the monocular tests were made. Then plus and minus lenses of low denomination are placed before the eyes, gradually increasing the strength of the lenses until the indicia are no longer readable. These limits are recorded, and correction for distance made as in the monocular tests.

It has been noted repeatedly that the monocular and binocular end points are not necessarily identical, even in cases in which the monocular regional accommodative amplitude is equal in the two eyes. In many instances the binocular positive element is only half that of the monocular, while the negative element is the same for both monocular and binocular tests. No cases have been observed in which the binocular positive element exceeded the monocular. In cases in which the binocular was appreciably less than the monocular positive element, the convergence maximum was insufficient. However, some patients with a definite convergence insufficiency manifested equal or nearly equal readings of the positive element, both on monocular and binocular tests. They generally manifested good accommodative function or even an excess.

It is perhaps too elementary to point out that the spherical addition for near vision in presbyopia requires more consideration than merely increasing the correction over the distance determination by some convenient rule of a definite amount of sphere for each year after average presbyopic onset. The indiscriminate addition of equal amounts to each eye routinely, is likewise only an estimate and not a measure of correction. The near correction should satisfy equality regarding the near point of accommodation, the far point, and the range and region in each eye as nearly as possible.

Convergence

The patient's position is maintained and both eyes are now tested simultaneously, the small card carriers being moved to the far end of the scale or removed entirely.

The middle scale is adjusted so that the first marking on the scale, which is 5, is 5 centimeters from the anterior surface of the cornea.

Maximum Convergence

This phase of the subject has been covered in the earlier paper referred to at the beginning. In it a chart is published which simplifies the use of the instrument.

Reserve Convergence

Noting the amount of maximum convergence and the amount of convergence in use at the patient's usual work distance, the amount of *reserve convergence* is represented by the difference between the two readings. If the amount of convergence in constant use approaches too closely the maximum convergence, there will necessarily be a low reserve, and consequent symptoms of discomfort, or limited ability to perform close work with comfort. At least 6 meter angles of reserve should obtain.

CHART 1

CONVERSION OF PRISM-DUCTION POWER INTO METER-ANGLE VALUES

Δ	M.A.	Δ	M.A.	Δ	M.A.
4	1.24	16	4.97	28	8.72
5	1.54	17	5.06	29	9.03
6	1.87	18	5.6	30	9.33
7	2.18	19	5.89		
8	2.46	20	6.21		
9	2.79	21	6.54		
10	3.12	22	6.85		
11	3.42	23	7.15		
12	3.70	24	7.46		
13	4.05	25	7.78		
14	4.36	26	8.07		
15	4.66	27	8.58		

Amplitude of Convergence

A chart is appended, in which prism-duction power, determined in the usual way, is converted into meter-angle values. In this way the maximum amount of relaxation of convergence added to the divergence in meter angles, expresses the patient's amplitude of convergence.

Indication is given as to the proper correction which will provide a sufficient reserve and insure comfort to the patient at the work distance.

By these tests the presence of convergent insufficiency or excess is evident.

These tests are performed without the correction to determine the patient's muscular ability, and then with correction to determine satisfaction of the patient's requirements.

Alternate fixation or suppression is also brought out in the performance of these tests.

Comparison of the Accommodative and the Convergent Functions

With the various phases of accommodation expressed in diopters, and convergence expressed in meter-angle terms, the following comparisons can be made:

(a) Comparison of maximum accommodation and convergence

(b) Comparison of accommodation and convergence at any near point or usual work distance

(c) Comparison of reserve accommodation and convergence, maximally, at usual work distance, or any specified near point, which will assist in defining accommodative convergence insufficiency or excess.

In these tests the convergence is kept constant while the accommodation is being determined, and the accommodation is a known quantity while the unknown convergence is being determined. In other words, all other conditions are maintained at a constant while one single function is being determined.

Comment

In routine refractions the measurement of phoria and duction is commonly done, although the status of accommodation and convergence, maximal, relative and associated, for near-work distance is for the most part, neglected. The latter functions cannot be surmised from the phoria and duction determinations. Without an adaptable means such as this instrument affords, these tests are necessarily time consuming, fatiguing, and not correlated.

It is a simple matter to include the usual prism appliances for near-duction

as well as for phoria examinations.

Much has been written of the change occurring in the phoria status when the direction of gaze is directed elsewhere than directly ahead with visual axes parallel. Nothing has been recorded in the literature of the effect of accommodation and convergence under these conditions.

This instrument is adaptable for such measurements by tilting the beam vertically, by rotating the chin rest laterally, and readjusting the rails in relation to the changed position of the head.

In cases of accommodative convergence insufficiency the latent period of accommodative action is definitely slowed down, as is seen when testing the positive relative accommodation for near.

In alternating-suppression cases the relative accommodation is generally greater for the fixating eye.

Symptomology is not always proportionate to the existing error. The matter of the reserves offers the best solution.

Patients with a high exophoria, but with a good near point of convergence, tolerate plus corrections well, since the position of rest only is faulty, and normal convergence power is present, although it may be latent. These may be designated as cases of functional accommodative convergence insufficiency.

In duction insufficiency there is generally an accommodative spasm.

In convergence insufficiency there is usually a remote near point of accommodation.

In general, the greater the esophoria, the greater is the positive relative accommodation; which explains why some patients tolerate a definite imbalance with few symptoms. They usually have a sufficient reserve of accommodation to satisfy overconvergence.

In general, the greater the exophoria, the less is the positive relative accommodation.

As a definitely high exophoria for near becomes less, the convergence near point becomes nearer in young patients.

Spasm of accommodation is often due to the excess convergence impulse necessary to overcome the exophoria.

Accommodative spasm in hyperopic subjects is usually an accommodative convergence excess. The counterpart is observed in patients with so-called relative hyperopia, who acquire strong convergence tendencies when they try to correct the hyperopia by strong accommotion.

Conclusion

Inasmuch as a large number of cases of heterophoria are cured or greatly improved by correcting the refraction alone, greater precision in prescribing refractive corrections should be observed, not only in consideration of the positions of rest and ductions, but also with due regard to accommodation and convergence in their various phases, and their respective balance relationships; especially if a definite disproportion of accommodation and convergence exists.

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THE REACTION AND BUFFER ACTIVITY OF NORMAL OX LENSES*

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The determination of the reaction or hydrogen-ion concentration of biological tissues, such as the crystalline lens, is much more difficult than that of fluids. For this reason comparatively little work has been done on the lens. There are many methods for the determination of hydrogen-ion concentration, but only one is fundamental, and against this all other methods are standardized. In this method, commonly known as the hydrogen-electrode method, a platinum foil, coated with platinum black, in the presence of a continuous stream of hydrogen serves as a hydrogen electrode; the other electrode is a calomel cell, consisting of mercury in equilibrium with a paste of mercurous chloride and mercury; the electrolyte is potassium-chloride solution saturated with mercurous chloride. This method, as ordinarily employed, requires 10 c.c. or more of the fluid that is to be tested. It is apparent that the lens, in its original condition—that is, undiluted with water—cannot be used in this method. If, however, the chemical make-up of the lens is such that it can act as a strong buffer, a moderate dilution with distilled water will have practically no effect on its hydrogen-ion concentration. And if, in addition, the lens contains no free carbon dioxide, the pH can be accurately determined on the aqueous lens emulsion by the use of the hydrogen electrode. Sharp and Powell,[1] using the hydrogen electrode, determined the pH of egg white and yolk, both in their original or undiluted condition and also diluted with various amounts of distilled water. They found the pH of undiluted egg white and yolk to be 7.82 and 5.93, respectively; after adding 12 c.c. of water to each, they were 7.89 and 5.94. When 14 c.c. of water was added to fresh samples from another egg, the respective pH readings were 7.92 and 5.96, and after adding 200 c.c. of water to each, the pH values were 7.93 and 6.23. Evidently the contents of the egg in their natural fresh condition possess remarkable buffer properties; especially is this true with respect to egg white, a dilution from 14 c.c. to 200 c.c. producing practically no change in pH. Since the lens substance, in its physical appearance, resembles that of egg white, it was thought that it might possess similar buffer properties and thus lend itself to the study of its reaction by the hydrogen-electrode method.

In this study the lenses of one-month-old calves and two-year-old cattle were used. Each lens was macerated in a mortar to a homogeneous paste, emulsified in distilled water, and diluted to either 15, 40, or 80 c.c. The emulsion was then transferred to a glass vial just large enough in diameter to contain the two electrodes of the apparatus. A few drops of amyl alcohol were added to prevent foaming on passing a stream of hydrogen through the emulsion.

The pH determinations were carried out on four calf lenses within half an hour after the death of the animals. Each lens was emulsified in 15 c.c. of distilled water, and the hydrogen-ion concentration was determined on this emulsion. Their pH values were found to be 7.55, 7.50, 7.70, and 7.50. Two calf lenses were exposed to the laboratory atmosphere for eight hours, then treated as those just described; their pH values were found to be 7.45 and 7.50, indicating practically no change in reaction. One calf lens that was

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emulsified in 40 c.c. of distilled water and tested within one-half hour after death of the animal had a pH of 7.60. The second lens of the same animal was emulsified in 80 c.c. of distilled water, and its pH likewise was 7.60. Ten lenses obtained from two-year-old cattle were emulsified in 15 c.c. of distilled water within two hours after death of the animals. Their pH values were as follows: 7.45, 7.45, 7.45, 7.45, 7.40, 7.50, 7.39, 7.34, 7.37, 7.32, an average pH of 7.43. Two lenses from cattle of the same age were exposed to the laboratory atmosphere for eight hours, then emulsified in 15 c.c. of distilled water; each had a pH of 7.40. Two fresh lenses from two-year-old cattle, removed from the eyes within one to two hours after death, were emulsified in 40 c.c. of distilled water; each had a pH of 7.50. Each of two similar lenses that were emulsified in 80 c.c. of distilled water, had a pH of 7.60 (table 1).

TABLE 1

MINIMUM, MAXIMUM, AND AVERAGE pH VALUES OF FRESH AND STALE LENSES

	"Fresh" lenses (½ to 2 hours after death)			Stale lenses (exposed to air for 8 hours)
Age of Animal	15-c.c. dilution	40-c.c. dilution	80-c.c. dilution	15-c.c. dilution
	pH	pH	pH	pH
1 month	7.50–7.70	7.60	7.60	7.45, 7.50
Averages	7.56 (4)*	7.60 (1)	7.60 (1)	7.48 (2)
2 years	7.32–7.50	7.50, 7.50	7.60, 7.60	7.40, 7.40
Averages	7.43 (10)	7.50 (2)	7.60 (2)	7.40 (2)

* Figures in parentheses indicate the number of lenses studied.

It appears from the foregoing data that the lens tissue of calves is slightly more alkaline than that of two-year-old cattle, their respective pH averages being 7.56 and 7.43. The buffer activity of the calf lens is such that an increase in dilution from 15 to 40 c.c. for a single lens produces on the average an increase of only 0.04; that is, an increase from a pH of 7.56 to 7.60. The same difference was shown when there was an increase in dilution from 15 to 80 c.c. When the lenses were exposed to air for eight hours and the pH determinations were carried out on 15-c.c. dilutions, the reaction shifted toward the acid side by only 0.08; that is, from a pH of 7.56 to 7.48, this change evidently being due to slight autolysis of the lens protein. Similar changes were observed in the lenses of two-year-old cattle. A change in dilution of the lens from 15 c.c. to 40 c.c. resulted in an average increase in pH of only 0.07 (from 7.43 to 7.50), and a dilution to 80 c.c. resulted in an average increase of 0.17 (from 7.43 to 7.60). On the other hand, there was a slight decrease in pH, amounting to 0.03, when the determinations were carried out after the lenses were exposed to the laboratory atmosphere for eight hours; that is, a decrease from a pH of 7.43 to 7.40.

On the basis of the foregoing results it is apparent that practically no change in pH of the normal ox lens occurs with emulsification in 15 c.c. of distilled water. Therefore the electrometric method with the hydrogen electrode is applicable in pH studies of normal lenses that approximate the size of calf lenses, provided there is no appreciable amount of free carbon dioxide. So far, according to my knowledge,

there are no direct experimental data showing whether the normal lens does or does not contain free carbon dioxide. Sauermann[2] in his pH studies of normal cattle lenses used the Michaelis[3] colorimetric method in which precautions were taken to prevent the escape of carbon dioxide. He reports the following pH values: 7.4 for 40 lenses, 7.5 for 7 lenses, and 7.6 for 3 lenses, an average pH of 7.43. This is in exact agreement with the average value obtained in the present work on two-year-old cattle. And although Sauermann fails to state the age of the animals from which he obtained the eyes, it is safe to assume that the latter came from animals of approximately the same age—that is, two years old—for this age greatly predominates in cattle used in abattoirs. It is therefore evident that there is no free carbon dioxide in normal ox lenses.

Summary

The hydrogen-ion concentration and the buffer activity of normal calf and two-year-old cattle lenses were studied electrometrically, using the hydrogen electrode and a saturated calomel cell. In this study it was found that if a single lens is emulsified in 15 c.c. of distilled water, the dilution, on account of the high buffer property of the lens substance, produces practically no change in the hydrogen-ion concentration. The average pH of calf lenses is 7.56 and that of two-year-old cattle is 7.43. The latter figure is in exact agreement with the pH value found by Sauermann for normal cattle lenses by the Michaelis colorimetric method in which precautions were taken to prevent the loss of carbon dioxide. It is therefore concluded that normal cattle lenses contain no free carbon dioxide.

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THE DISLODGING FORCE UTILIZED IN INTRACAPSULAR CATARACT EXTRACTION

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It has long been a wonder to me that so few[1] of those gifted in argumentative writings have come forward and expressed themselves regarding the force that is required to remove the lens in capsule from the eye A knowledge of its application is basic, and the very success of an ideal procedure depends upon knowing just how this force should be directed. I have labored under the impression that its application has been misunderstood, else the giants of learning would have written more instructively as regards their special techniques, so as to rescue those committing error and better qualify ambitious novices. On many occasions, I have analyzed the adroitness of successful surgeons while they delivered the force, and have remembered fundamental teachings regarding the lens attachments and surroundings to conclude that the surgeons did not break the bonds of the lens by pulling on either the lens or its capsule. It is my conviction, after witnessing many operate and after great personal experience, that no matter what intracapsular procedure is adopted the lens is not extracted by the use of force applied as traction.

Unless it becomes fully known "that the lens is not pulled from the patellar fossa," the young surgeon cannot hope to succeed, nor can general acceptance be expected for the intracapsular procedure. The statement is so ostensibly correct that it should pyramid writings on the cataract operation.

Although the capsule of the lens is grasped with forceps in the most popular of techniques, and movements of the hand reveal a pull and zigzagging of the lens from the eye, but little trust should be put in this particular finesse. Watch the other hand rupturing the zonules by making pressure with a rod or spoon. It is not the force that appears as actual to eye and mind that accomplishes the removal of the lens, but the inapparent push exerted by the rod wedging the lens from the vitreous. You may ask, therefore, why forceps and vacuum discs are used to grasp the capsule, when the capsule is frequently torn in using these instruments; or, what purpose they serve since they do not break the lens from its moorings. Colonel Smith answers that they are unnecessary, "a push applied to the tip of the lens through the cornea is alone essential."

J. Russell Smith[1] witnessed Barraquer using a vacuum disc, "in which the lens was seized and drawn out of the eye in its capsule," without deforming pressure having been applied to the outer wall of the globe. But, upon studying slow moving pictures, it became clear to him that "Barraquer's success could not have been achieved by pulling," for "he dislocates the lens by pushing it bodily back into the vitreous, a course which would impose no strain on the grip of the instrument which it was not fit to stand." He adds that the secret of success depends on "pushing instead of pulling."

Procedures, such as "the combined forceps and expression techniques" of Stanculeanu, Knapp, Török, Lancaster, and Davis, diminished the "brute force" of Smith. Colonel Smith did not grasp the lens capsule with instruments but applied a hook at the limbus to the lens periphery, making pressure with it to break the attachments between the lens and ciliary processes, using the vitreous for a cush-

ion. The other surgeons directed the force as did Smith, but while doing so passively held the lens capsule so as to have the force transmitted between the lens and vitreous.

Davis says, ". . . in no way is the force of the combined procedure" (in which the capsule is grasped with forceps and pressure delivered) "comparable to the force formerly exerted in the Smith operation." He further states that the pressure used in the combined techniques "is 95 percent push and but 5 percent pull" yet the push is gentle in that it is directed between lens and vitreous.

A knowledge of this procedure has brought great success to many adopting the intracapsular method, and the want of such information has resulted in failure for others.

It is my surmise, that Smith's superior dexterity lies in manipulating the hook to get behind the lens, although he did not convey this information in his writings, and Barraquer's success definitely did not depend upon a pull, although be used a vacuum grasper. Those using the combined procedure wedge the lens from the vitreous, but do not pull it from its attachments. Barraquer, after rupturing zonules by a push instead of a pull, topples the lens sidewise to direct it out of the eye.

I have adopted and for some time utilized a net for removing the lens in capsule, in fact a zonulatome[7] that encircles the lens and presses around it, causing the lens to swell up and become ensnared in cross wires. The lens is grasped bodily; but even so the instrument is not used to pull it out. The zonulatome directs the lens after the zonules have been ruptured. I have also developed another instrument. It is very much like Barraquer's grasper, but makes intermittent suction on the capsule, breaking the zonules.[8] It requires no force, neither pull nor push, to get the lens in capsule from the eye.

Having accounted for the success of the procedures, it becomes necessary to explain why a push on the lens is better than a pull. To do this, I have made models of the eye for demonstrating the different procedures and for creating slow moving pictures. Cords and rubber tubes were used to develop action. The lens, in the fossa of the vitreous, is seen to be fenced by the scleral spur, against which it becomes jammed if direct pull is made. The model with cornea and iris removed, reveals that the lens cannot be made to slide over the scleral fence. It might be caused to mount the fence after the distal side of the lens has first been pushed down into the vitreous; otherwise it is brought over by toppling. If the wedge is inserted between the lens and the vitreous on the distal side, the proximal side acts as a hinge. A revolution of 180 degrees is produced at the hinge when the force follows the lens outward. The scleral spur, which I have designated a fence, is the all-important point in applying pressure. If the force is applied behind the ridge it must accomplish its effect by distorting the vitreous, whereas, if applied in front of the ridge, the force is delivered between the lens and vitreous.

To what extent the applied force may affect the stability of the vitreous should always be kept in mind. Fortunately nature in her wisdom designed a semisolid vitreous inclosed within the scleral envelope the aperture of which is smaller than the diameter of the sphere; hence the normal vitreous must be fractured before it can get out of the eye. If the vitreous has become liquid, the opening made for the extraction of the lens is sufficient to spill it from the eye, for the spherical shape of the eye is changed by the incision into the globe. When the vitreous is liquid it will spill, for a sphere has a greater capacity than any other form of container.

It would be almost impossible to meas-

ure the sustaining strength or the degree of force required to produce fracture of the vitreous, particularly when the normal vitreous and eye are considered. The force applied by Stanculeanu, Knapp, Török, Lancaster, Davis, and others in their respective operations is much greater than they acknowledge. Pressure properly directed is a prerequisite for success. As soon as the zonules rupture, and the probe reaches behind the lens, there is no longer pressure on the vitreous but away from the vitreous to the back of the lens, and slowly the remaining attachments are broken as the instrument follows the lens out of the eye.

The vitreous as a mass maintains itself better against a pushing than against a pulling force. When pushed upon, the vitreous resists like an elastic body; when pulled upon, its surface tension is weakened, lessening a force that provides greatly for its integrity.

Unless it is known that the lens should not be pulled from the eye in the course of performing the intracapsular cataract extraction, eyes will be lost and the procedure ultimately abandoned. I am convinced that many do not know the importance of this statement. The maneuver used for dislodging the lens should be thoroughly understood by every ophthalmic surgeon. With this in mind, given the deftness of hand required for the intracapsular procedure, there is no reason why the many may not obtain the skill of the few.

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NOTES, CASES, INSTRUMENTS

A NEW ORBITAL IMPLANT

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The tolerance of the orbital tissues to foreign materials is well known, and for this reason many substances have been implanted in Tenon's capsule in order to obliterate unnatural folds and depressions in the upper and lower lids. Implants also prevent ptosis, impaired motility, and sinking of the artificial eye. My[1] special interest in this subject developed during the World War, but it is not my intention in this article to discuss the merits of the numerous implants. I wish, however, to call attention to a new implant constructed of an alloy called vitallium; a product of the Austenal Laboratories of New York City.

As metallurgical knowledge[2] increases, particular alloys are developed for specific fields, and in their applications exhibit advantages of superior properties not obtainable in the constituent metals of which they are composed. Vitallium is a casting alloy, 90 percent of which is composed of cobalt and chromium with a smaller percentage of molybdenum, and is designated as a cobalt-chromium alloy. The alloy is exceptionally strong and hard, very light, and has been found[3] to be completely inert and most compatible with living tissue, producing no tissue nor electrolytic[4] reaction. This has been shown in a series of very interesting experimental studies. Vitallium has a specific gravity of 8.29,—much less than the specific gravity of pure gold, which is 19.3, or of casting golds, which range from 14.0 to 18.0. This material resists strong mineral acids, and a solution of sodium chloride of any degree of concentration over any period of time produces no effect on it. Vitallium has been used for a considerable time in prosthetic dentistry, and now plates and pins[5] have been most successfully used in the treatment of fractures.[6] The idea occurred to me that such a material is suitable for orbital implantation, and I presented the first model before the New York Ophthalmological Society during the April, 1938, meeting.

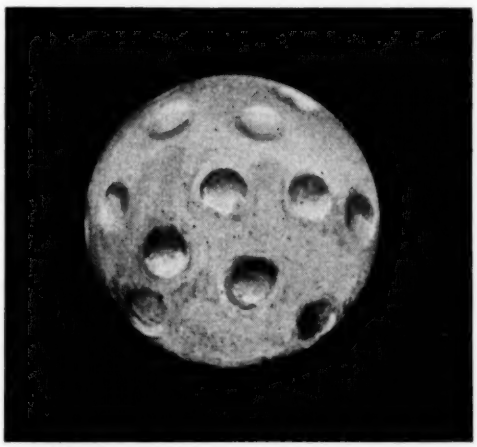

Fig. 1 (Doherty). Vitallium orbital implant.

I wish to extend my appreciation and thanks to the Austenal Laboratories of New York for their kind assistance; and to E. B. Meyrowitz of New York for the excellent photograph.

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REPORT OF TWO CASES OF UNILATERAL RETINITIS PIGMENTOSA*

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The occurrence of bonafide cases of unilateral retinitis pigmentosa again stirs up the controversy of etiology.

In spite of the fact that numerous theories have been promulgated regarding the pathogenesis of retinitis pigmentosa, no single author has been able to offer an unassailable explanation. The abiotrophic theory is supported by the occurrence of cerebral involvement in atypical cases of tapeto-retinal degeneration but does not go well with unilateral occurrence. The suggestion of traumatic origin of the disease, promoted by Wagenmann's[1] experiments, is not consistent with the statistics, which show that retinitis pigmentosa following trauma is practically unknown. The angiospastic theory is surely unsatisfactory, because it is difficult to conceive the occurrence of arteriolar spasm at an early age and limited to retinal vessels. Also, if this were true, retinitis pigmentosa should be a common occurrence in essential and malignant hypertension, which it is not. Neither does it occur in secondary atrophies associated with optic neuritis, retrobulbar neuritis, or toxic amblyopia. Certain it is that in all typical cases there is gradual occlusion. So constant is this vessel change that without it diagnosis is impossible. Moreover, so characteristic is the appearance of the disc and vessels, that, in the absence of malignant hypertension, the disease may be recognized before the periphery or pigment spots are seen. The pigment appearance so constantly observed in retinitis pigmentosa is also seen in other diseases, such as retinosis, choroidosis, choroideremia, chorioretinitis, topical senile degeneration of the peripheral retina. The arterial picture, however, belongs to retinitis pigmentosa.

It is not likely that the retinal vessels are narrow because of general atrophy of the retina of which they are really not a part. In diffuse chorioretinitis where practically the whole retina is destroyed, the retinal arteries are usually normal.

It seems to me that if we could find an explanation for the gradual narrowing of the vessels, we would hit upon a workable theory applicable to the etiological solution. We know now that narrowing of vessels with fibrotic and hyperplastic changes is caused by any form of occlusion. Whether that occlusion is produced by an embolus, thrombus, pressure, or spasm makes very little difference. Hence, the vessels found in retinitis pigmentosa resemble those in malignant hypertension, or following intra- or retrobulbar neuritis. In other words, the vessel changes are not secondary to general atrophy but secondary to pressure and occlusion.

We can conceive the occurrence of a topical neurofibromatous formation. Such formation may be limited to the central portion of the optic nerve or may be found elsewhere in the nervous system. This would explain the cerebral cases and

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* Presented at the New York Academy of Medicine, Section on Ophthalmology. April 18, 1938.

possible association with otosclerosis. In explanation of this hyperplasia one might draw a parallel with what happens in Von Recklinghausen's disease. Wagenmann's experiments also should not be disregarded. He showed that cutting off the vessels behind the globe in rabbits resulted in pigmentary degeneration. Trauma to the eye could not result in pigmentary degeneration unless by scar tissue; the retinal vessels were compressed. My own experiments on rabbits, consisting of injection of alcohol into the optic-nerve trunk of the rabbit, gave results similar to Wagenmann's.

It appears that sudden blocking of the retinal artery does not produce pigmentary degeneration, but very gradual occlusion occurring early in life (retinitis pigmentosa has its onset between the ages of three and eight years, according to Hoering[2] and others) causes a gradual degeneration of the periphery with replacement of necrotic spots by proliferating pigment epithelium. This happens because the terminal small arterial branches become fibrotic, and early in the disease lose their patency.

Shoemaker,[3] in his monograph, shows a massive hyperplasia within the optic nerve, as a post-mortem finding. In our pathological laboratory at Montefiore Hospital, Dr. Smoleroff and I have been able to demonstrate similar changes. The occurrence of unilateral retinitis pigmentosa, of which there should be no doubt, while it militates against other theories, does not conflict with the theory of intraneural hyperplasia.

Dr. M. N. Beigelman[4] gives a résumé of 11 cases of unilateral retinitis pigmentosa reported since 1865. In that year the first case was reported by Pedraglia.[5] The oldest patient was 42 years of age and the youngest 10 years of age.

Case 1. M. W., aged 53 years, complained of poor vision of the right eye for at least 38 years. The right eye showed retinitis pigmentosa with posterior cortical cataract and optic atrophy. Vision O.D. was ability to see hand movements on the temporal side only. The fields of vision of the right eye could not be taken with the largest test object. The left eye was normal with 20/25 vision and a full field. Laboratory tests were negative except for a positive sputum for tuberculosis.

Case 2. Mrs. S. H., aged 45 years, noticed poor vision in the left eye at the age of 14 years. This eye showed a posterior cortical cataract and typical retinitis pigmentosa with sclerosis of choroidal vessels; very thin retinal arteries and "apple sauce" color pallor of disc. Vision was light perception in the temporal field. The right eye was entirely normal as was also the general health.

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THE RESULTS OF SQUINT OPERATIONS: A REVIEW OF THE LAST 286 CASES AT THE UNIVERSITY OF OREGON CLINIC*

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The review of this series of squint operations performed during the last 10 years in connection with the clinic of the University of Oregon Medical School represents results obtained by a great variety of operators of varying degrees of surgical ability and experience, using various operative procedures. It can thus probably be considered a fair cross section of operative results in muscle surgery the world over. In other words, any deductions possible, apart from such as might suggest improved procedures in our own clinic, are exceedingly general and probably applicable to squint operations everywhere.

The esotropia cases outnumbered those of exotropia nearly eight to one, being 244 as against 31. There were eight cases with vertical phoria. The patients, nearly all children, averaged 10.9 years in age. The proportion of strabismic children to children-clinic-attendance was about 1 in 42. The figures cover only the last 10 years and deal only with nonparalytic cases. The university clinic has been operating since 1931; the Doernbecher Memorial Hospital for Children, connected with the university, was opened in 1926.

These operations were performed by 12 operators, all practicing ophthalmologists, save for a few done by the resident in ophthalmology, whose qualifications require that he shall have had at least one year of special training before appointment. All major surgery is performed under the supervision and in the presence of the senior clinician in charge.

All types of operations were employed. The total number of so-called "weakening" operations was 214 (170 partial tenotomies, 44 recessions). A total of 250 shortening operations included 43 advancements of various types, 56 resections, 38 tuckings, and 113 cinch operations. Surgery was usually limited to a single eye; in only eight cases were bilateral tenotomies or cinch operations performed. In 17 cases one eye was treated at the first operation and the second eye at a subsequent time. In 186 cases two or more muscles were attacked, while in 92 only a single muscle. Two hundred thirteen individuals were operated on by a single operation; 18 had two operations; two individuals were operated on three times; one, four times; and one, five times.

The average amount of esotropia prior to operation was 27 degrees. By a strange coincidence the same amount (27 degrees) of exotropia also was found. And following operation 13 degrees of esotropia and 14 degrees of exotropia persisted.

One postoperative death occurred. The only other catastrophe in the series involved a patient with an abnormally thin and nonresistant sclera which was cut through at the point of a tenotomy. A uveitis followed and the vision is at present reduced to 10/200.

A comparison of the results obtained by various operators shows surprisingly little variation. An operation by a resident of comparatively little experience produced occasionally a remarkably good result, due partly to good fortune and

* From the Department of Ophthalmology, University of Oregon Medical School. Read at the meeting of the Pacific Coast Oto-Ophthalmological Society, June, 1938, at Victoria, British Columbia.

partly to good supervision.

If any deductions are justifiable from the entire study they are these: that no single operative procedure can be relied upon to produce perfect results in all cases; that dexterity in carrying out any technique is the great desideratum; that the average operator will do well after careful study of his cases to limit himself to a single or at least to a comparatively few types of operation and to perfect himself in these types rather than spread himself out thin by trying one type of operation after another, experimenting with every new procedure suggested; and finally that with experience there develops a surgical judgment and intuition that cannot be expressed in words nor in terms of advice.

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STANDARDIZATION OF THE PREPARATION OF EYE DROPS

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It will be undertaken in this paper to form a definite plan, based on scientific research, of presenting a solution for a most neglected problem in the field of ophthalmology; namely, that of standardizing the preparation of eye drops.

It will be observed in visiting hospitals, ophthalmologists' offices, and drug stores, that the preparation and changing of eye drops to fresh solutions is deplorably neglected. One has only to notice the dates of expiration to learn that in many cases a change is long past due or there are no dates at all. Most hospitals, however, apply an expiration date, but this is not the rule in private practice, nor do the majority of druggists apply the expiration-date method in dispensing eye drops to patients. Upon holding these bottles to the light, all variations of floating sediment can be seen, and when cultured a bizarre number of bacteria, yeasts, molds, and fungi can be grown. These are pathogenic and nonpathogenic.[1] Nonpathogenic bacteria alter the constituents of the solutions considerably; for example, Sabalitschka reports the reduction of a solution of calcium chlorate to a chloride within 12 months,[2, 3] and potassium chlorate to a chloride in one week.[4] This did not occur with the addition of a proper preservative. Alkaloids are also altered in their effectiveness according to Tagliavini.[5] He observed that ampoules of scopolamine and opium become ineffective because, due to improper sterilization, molds had destroyed the alkaloids.

The question can now be stated. Should we not attempt a standardization process whereby, at least in the literature, a simple method for eye-drop preparation can be obtained? Those of us using and dispensing these solutions should insist upon their correct preparation in this standard way; and it will be shown that sterility can be maintained, deterioration lessened, expense reduced, physiological properties instituted, and danger from infection lessened.

Eye solutions are contaminated after being used once or twice, and after two or three days, when cultured on agar plates for 10 to 12 hours, yield many and varied types of bacteria.[6] This occurs from touching the dropper to the eyelids or from dust particles falling into the solution. The eye solutions usually contain no preservative nor germicidal agent to maintain sterility and there is, therefore, always danger of the transfer and introduction of infection to the eye, particularly pre- and postoperatively.

The germicide and preservative widely used in Europe for sterilization of eye solutions is the Nipagin-Nipasol combina-

tion. These substances are the ester derivatives of benzoic acid: p-oxybenzoic acid-methyl, ester (Nipagin-m); p-oxybenzoic acid-propyl, ester (Nipasol-m). These are organic chemicals which have the aforementioned necessary qualifications and in addition are tasteless, odorless, easily soluble in lipoids and boiling water.[7] They do not affect the reaction, smell, taste, color, or consistency of the materials with which they are to be used. They are also unaffected by dilute acids and bases, but are affected by strong bases when boiled for a long time. They are fine, white, crystal powders, and will last indefinitely, even in a dissolved state, without impaired efficiency. They also dissolve with a neutral reaction; therefore, they do not affect the pH of the solution.

Nipagin-Nipasol is nonpoisonous and nontoxic to man when used in even larger amounts than are to be used here. They are harmless when used as preservatives for foods and pharmaceutical preparations, and two to four times less harmful than phenol, and without cumulative effects.[8] These esters were tried on guinea pigs, dogs, and cats before being given to human subjects. From the results obtained with animals, the toxic and lethal doses were computed for humans.

	Toxic	*Lethal*
Nipagin-m	150 gr.	225 gr.
Nipasol-m	225 gr.	450 gr.

The small amounts suggested in this article for the preservation of eye drops would, therefore, be entirely harmless, and are adequate for preserving and disinfecting the solutions.[9]

These two esters, Nipagin and Nipasol, when combined were found to be the most effective preservatives and germicides of all the benzoic acid esters.[2] This combination in a 1-percent solution, as found by the author, reacts to kill a mixture of B. coli and Staphylococcus pyogenes aureus within two hours. It was further found that 0.05-percent Nipagin-m plus 0.05-percent Nipasol-m in solution killed these organisms within six days. This also was true when applied to common molds, yeasts, fungi, gram-positive and gram-negative bacilli. Since turbidity is observed in many stock buffer solutions, it has been traced to the growth of a species of Torula, which are also killed. Leschke found that a 0.06-percent propyl ester solution (Nipasol-m) would guarantee lasting sterility.[10] As to resistant spores, Eschenbrenner found it possible to kill them with a 0.1-percent Nipagin-Nipasol solution in 15 minutes by boiling at 100°C., while, without using this ester combination, it took four hours to effect the same result.[11] Sabalitschka and Böhm compared Nipasol, Phenol, and Tricresol as to their germicidal effects, and found that Staphylococcus pyogenes aureus, B. coli, and Para-typhoid B., in nutrient agar, were killed in one day with the addition of 0.056-percent solution of Nipasol, while it took a 0.3-percent solution of phenol, and a 0.1-percent solution of Tricresol to do the same.[13]

In reviewing other papers, much evidence was found concerning the germicidal and preservative quality of these esters, with information on various organisms—anaerobes, aerobes, spores, fungi, yeasts, and molds—and in each the organisms were killed with Nipagin-Nipasol combination.[3, 12, 7, 13]

The recommended dilution for the sterilization of eye solutions is a combination of 65 parts Nipagin-m plus 35 parts Nipasol-m.[14, 15] This low concentration is sufficient to prevent the growth of new organisms and to take care of those already present; yet to the patient it is nontoxic and nonirritating. It is chemically neutral to the eye solution. One cannot expect to have immediate germicidal effect with this

low concentration; however, it will kill Staphylococcus aureus in 24 hours, and will prevent the growth of fungi.

Recently chlorobutinal in a 0.5-percent solution has been recommended for sterilization and preservation of eye solutions. It is doubtful that this will prove useful, not because it may not be a good preservative, but because it stings the eye too severely. In comparison, an eye solution with a Nipagin-Nipasol preservative added gives a slight sting; with an acid buffer, this is less; and still less with an alkaline buffer. All solutions listed in the table, except the zinc salts, produce a mild sting at first; the zinc preparations a distinct smart, but all are followed by a most refreshing sensation in comparison to the effect of contaminated drops, the sting of which is great. This mild sting is not uncomfortable, and should offer no disadvantage. Most adults and children flinch whenever anything is done to the eyes. Chlorobutinal is precipitated from solutions with a pH above 7.5. It is also worth mentioning that the preparation of chlorobutinal is very time consuming to a busy pharmacist because it is difficultly soluble in an aqueous solution.

After selecting the best-known preservative and germicide with the requisite qualifications, which are sound in every respect to date, it is necessary to have all solutions as near alike in pH value to the tears themselves as possible before an eye solution can be called perfect. There must also be a proper buffer value for each eye solution from which the medicaments can best be absorbed. Alkaloids are best absorbed and when used are less irritating in a slightly alkaline solution with a pH of 7.6. This latter subject has been very admirably worked out by Dr. S. R. Gifford.[16] By his permission, I am using some of his solutions (see table), others I am adding for a more complete list and have compiled them in a simplified table. With this guide any physician or druggist can prepare or have prepared the most commonly used eye solutions. There will be no difficulty in having at all times perfectly noncontaminated eye solutions that will be safe for the treatment of patients in offices, hospitals, and homes.

PREPARATION OF STANDARD EYE DROPS

1. Dissolve by boiling one minute in 1,000 c.c. of double-distilled water, 0.8 gm. Nipagin-Nipasol combination. This makes an antiseptic and preservative water.
2. *To prepare acid buffer solution:*
   Boric acid c.p. Gm. 12.4
   Potassium chloride crystals c.p. Gm. 7.4
   Dissolved in 1,000 c.c. of water as prepared in step no. 1.
3. *To prepare alkaline buffer solution:*
   Anhydrous sodium carbonate c.p. Gm. 21.2
   Dissolved in 1,000 c.c. of water as prepared in step no. 1.

The following table contains the proper proportions in which to use the buffer solutions to give the eye preparations their correct pH value. Any variation in the amount of the drug used in concentrations which might be used in the eye will not change the pH value. If the alkaline buffer solution is kept in a dropper bottle with a dropper giving 0.05 c.c. to each drop, the dispensing will be easier for the pharmacist.

Drug	Acid Buffer oz.	Alkaline Buffer c.c.	or drops	pH Value
Butyn	1	—	—	5.0
Phenacaine ...	1	—	—	5.0
Procaine	1	—	—	5.0
Cocaine	1	—	—	5.0
Ardenalin	1	—	—	5.0
Holocaine	1	—	—	5.0
Zinc salts	1	.05	1	6.0
Homatropine .	1	1.50	30	7.6
Euphthalmine .	1	1.50	30	7.6
Physostigmine.	1	1.50	30	7.6
Pilocarpine ...	1	1.50	30	7.6
Scopolamine ..	1	1.50	30	7.6
Atropine	1	1.50	30	7.6
Sodium fluoresceine .	1	8.00	160	9.0

Shortly after the publication of Dr. Gifford's article on buffer solutions, an experiment was made in which all eye

solutions were prepared accordingly, but it was found a heavier growth of fungi developed more rapidly in the buffer solution than in plain distilled water, therefore, Nipagin-Nipasol seemed to be the only preparation possessing ideal qualities for preserving eye solutions. It is a fact, however, that the damp climate that we have in the northwestern part of the United States is more conducive to bacterial growth, particularly fungi. East of the Cascade Mountains, where a drier climate exists, the growth in such solutions is less; therefore, our problem in this climate is more difficult.

Summary

After consideration of the work done upon this neglected problem of ophthalmology, the following summary is offered:

1. All eye drops when prepared for nonoperative use are contaminated, and bacteria grow profusely in these solutions.
2. In the damp climate of the northwestern part of the United States, fungi grow profusely in alkaline and acid buffer solutions when prepared without a preservative.
3. Suitable and well-proved benzoic-acid esters are used with the ideal acid and alkaline buffer solutions to preserve eye solutions, kill introduced bacteria, prohibit growth of fungi, and maintain and practically guarantee sterility for long periods of time.
4. Benzoic-acid esters have reliable preservative and germicidal powers and are nontoxic to the human eye.
5. The cost of changing and throwing away contaminated solutions is greatly lessened.
6. A convenient table for standarization and preparation of eye solutions is given.
7. The mild sting in using these preparations is not objectionable.

Appreciation is extended to Mr. George A. Tozer, pharmaceutical chemist, for the preparation of solutions required in this work.

611 Medical and Dental Building.

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COUNTERBALANCED WALL BRACKET FOR SUSPENDING COMBERG SLITLAMP

GEORGE N. HOSFORD, M.D.
San Francisco

Although the slitlamp and corneal microscope have added enormously to our knowledge of pathological processes in the anterior segment of the eye, I have long been dissatisfied with the available means of applying this instrument to the routine examination of patients. When the slitlamp is kept in a separate room to which it is necessary to move patients whose vision is impaired, to seat them on uncomfortable stools, where it is necessary to adjust the height of the instrument by slow-moving screws and to make many adjustments, the tendency is to omit the slitlamp examination of borderline or presumably normal patients. Some years ago, I insisted on mounting a Gullstrand (Zeiss) slitlamp on a table which rolled over the floor on large rubber-tired casters. I was warned by the agents of the manufacturers of this instrument that the vibration produced by rolling the instrument over the floor would be detrimental to the light source and to the delicate adjustments of the beam. While this may be true, I must say the instrument stood the experience remarkably well and when it was examined a few days ago by Mr. Victor M. E. Koch, vice-president and technical manager of Carl Zeiss, Inc., he assured me that the instrument was in perfect condition. This model of the slitlamp is too large and requires too much room to mount in any other manner and still preserve the benefits of the beam as it was originally planned to be used.

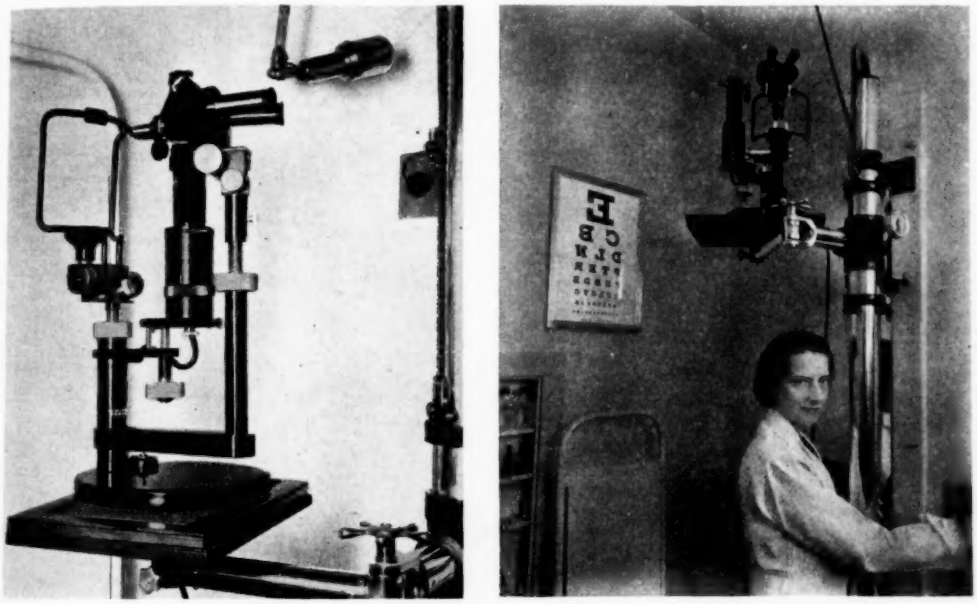

Fig. 1 (Hosford). Counterbalanced wall bracket for suspending Comberg slitlamp.

With the advent of the Comberg model, however, we have available a more compact instrument which weighs approximately 50 pounds. In looking about for some means of suspending this from the wall, in such a manner that it could be

pushed out of the way when not in use and quickly swung into position before a patient in a treatment chair, it occurred to me that a Pacifix wall-mounted counterbalanced stand would easily solve this problem. I interested Mr. Alfred Abend, of the Pacific X-ray Sales Company, in the matter, and he built a special arm to attach to this stand. A flat metal table measuring 9¾ inches by 14 inches, with a felt-covered hardwood top, affords ample space upon which to place the base of the slitlamp and upon which the elbows of the observer may be rested. The stand is firmly bolted to a stout piece of wood 8 feet long, 8 inches wide, and 1¼ inches thick; this, in turn, is firmly fastened to the wall. The vertical part of the stand projects out from the wall only 10 inches. There is a range of vertical motion of over five feet, and if the stand is placed one foot from the floor, it is possible to push the instrument above the height of the tallest patient when not in use. The instrument is counterbalanced so that it moves up and down with the greatest ease, aided by wide vertical bearing surfaces and the roller bearings. The arm is designed to support a weight of 350 pounds, so there is an ample factor of safety, and great stability is secured. Such a suspension has the effect of having the instrument on a universal joint, and it can be used with a facility comparable to that of the hand ophthalmoscope. The many types of hand slitlamps on the market bespeak a demand for a more usable instrument. With this suspension, however, the rather unsatisfactory hand types of slitlamp are rendered unnecessary and the range of usefulness of the Comberg slitlamp is greatly increased.

450 Sutter Building.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

WASHINGTON, D.C., OPHTHALMOLOGICAL SOCIETY

March 7, 1938

Dr. G. Victor Simpson, *presiding*

The use of benzedrine in refraction

Dr. Hunter McGuire, of Winchester, Virginia, brought out the fact that he had, during the past year and a half, examined some 300 cases, using the more recent technique of Dr. Beach. This consists, in patients over the age of 12 or 14 years, in the instillation of one drop of 5-percent homatropine in each eye to be followed in two minutes by one drop of benzedrine sulphate. Possibly a more complete cycloplegia can be induced if another drop of benzedrine is instilled five minutes later. Dr. McGuire emphasized the fact that cycloplegia is complete in one hour and refraction must be done promptly, since the peak of paralysis of the accommodation is reached rapidly and passes rapidly. It was emphasized that among the advantages of this new type of cycloplegic are: (1) fewer drops to be instilled with less annoyance to the physician and to the patient; (2) cycloplegia quite as complete as that with the classical method; (3) rapid return of accommodation. The patient is usually able to read fine print in about 10 to 14 hours and is easily able to return to work in 18 hours.

In patients below the age of 12 or 14 years, 1-percent atropine sulphate is instilled in the office and then followed by one drop of 1-percent benzedrine and five minutes later another drop of 1-percent benzedrine. With atropine the refraction may be done in about an hour and a half. The additional advantages in this type of cycloplegic over the classical method are: (1) the cycloplegic may be administered in the office and better controlled than in using the classical method; (2) the refraction may be largely done at the first visit as opposed to two or three visits by the classical method; (3) the return of accommodation occurs in four to six days, causing less loss of time in school.

Dr. McGuire emphasized the fact that in his experience the type and size of the refractive error is not a factor in ease of induction of cycloplegia nor in the length of time taken to recover accommodation. Pupillary dilation persists definitely longer than cycloplegia. The use of benzedrine sulphate has caused no rise in tension in any of his series of cases.

Discussion. Dr. Louis Greene summarized the findings in a series of 335 cases seen in private practice. Dr. Greene's technique and views differ with Dr. McGuire only in details. Dr. Greene had been accustomed to using 2½-percent homatropine and found it quite satisfactory. He found that all adult patients had sufficiently recovered accommodation at the end of eight or twelve hours to read comfortably.

Dr. William T. Davis believed that cycloplegia was probably more complete with this procedure than when using the classical procedure unless it were very scrupulously carried out.

Dr. McGuire, in answer to questions, stated that he had seen no toxic effect from the use of benzedrine or from the use of 5-percent homatropine, and that he had not used any miotic, either with the newer method of cycloplegia or with the classical method.

Symposium on the use of sulfanilamide in eye conditions

Col. F. H. Thorne gave a general discussion of sulfanilamide, briefly reviewing the history and listing the toxic symptoms and their treatment. He pointed out that he had found, after a not too thorough search, two cases in which sulfanilamide had been used for ocular pathology. Colonel Thorne himself reported a case of prostatitis under treatment in Walter Reed Hospital. The patient, prior to treatment, had 20/20 vision; 400 grains of sulfanilamide were given, and at that time the vision was reduced to 20/200 in each eye, though the eye was absolutely normal otherwise. The patient accepted a +3.50 D. sph. ⊂⊃ + .50 D. cyl. ax. 180° to obtain 20/20 vision in each eye. The drug was withdrawn and in one week the patient had 20/20 vision and read Jaeger 1 without any correction at 13 inches. Colonel Thorne reports this case as one of spasm of the ciliary muscle induced by the use of sulfanilamide.

Discussion. Dr. Thomas Egan reported a case of gonorrheal iritis in an adult. The patient had a low-grade iritis and during the hunt for a focus of infection, a prostatic massage was performed. The patient immediately had an acute flare-up of the iritis, which was typically gonorrheal. No medication was given other than instillation of atropine and the use of hot applications, plus the taking of sulfanilamide by mouth. In 24 hours the improvement was marked and the patient was well within 10 days, having a vision of 20/15.

Dr. Ernest Shepherd reported a case of streptococcic abscess of the lid in a child three years old. The child ran a septic temperature but had negative blood culture. The infection pointed through the lid near the outer canthus and was incised and drained. The patient was given 140 grains of sulfanilamide, small blood transfusion, and supportive treatment during the course of four or five days. The case ended with complete recovery other than the loss of skin over a large portion of the upper lid, which now is healing nicely.

Dr. Frank Costenbader reported a case of gonorrheal conjunctivitis in a child. The boy, aged four years, had been admitted to Children's Hospital with an acutely inflamed right eye, lids swollen completely shut, and much purulent discharge. He also had a purulent urethritis of several days' duration. When first seen it was almost impossible to see the globe or cornea because of intense swelling, congestion, and discharge. The patient was given 25 grains of sulfanilamide daily, and in 24 hours was opening the eye without aid, and the infection was 80 percent improved. Negative smears were consistent after four days but positive urethral smears were obtained up to the time of discharge (12 days).

Frank D. Costenbader,
Secretary-Treasurer.

SAINT LOUIS OPHTHALMIC SOCIETY

March 25, 1938

Dr. Roy E. Mason, *president*

Simultaneous color contrast and instrument for demonstrating it

Dr. Carl T. Eber read a paper on this subject which will be published in this Journal.

Discussion. Father H. Gruender, S.J., of Saint Louis University, said the modifications of his contrast box introduced by Dr. Eber are excellent. They make it easy to illuminate two contrasting surfaces independently—namely, a small infield and a large outfield—and to regulate with fair precision both the amount and kind of light reflected by each field. What

adds to the value of the instrument is the fact that standard color filters are used both for the infield and the outfield. It is also possible to produce artificially "white" light which approximates the composition of unfiltered sunlight. Thus ideal conditions are created for observing the profound influence which is exerted by the outfield on the infield. In literal strictness the inhibiting effect of the two contrasting fields is mutual but it is proportional to the size of each and to the amount of light reflected by each. Hence by making the infield very small and the outfield comparatively large, and by using very small amounts of light for the infield and comparatively large amounts for the outfield, we reduce the inhibiting effect of the infield on the outfield to a minimum. Thus we can practically consider the infield as the inhibited surface and the outfield as the inhibiting surface. By means of this instrument, then, it is possible to demonstrate experimentally that the characteristic appearance of the infield depends not only on the kind and amount of light reflected by that field and reaching the center of the retina, but also by the amounts and kinds of light reflected by the outfield and reaching the peripheral portions of the retina.

Suppose that we illuminate the infield by four units of "white" light. This light is at its best when the outfield is not illuminated at all: the infield under these conditions looks white. The moment we introduce a small amount of "white" light into the outfield, the infield looks darker. The greater the illumination of the outfield, the darker is the infield. When the illumination of the outfield reaches a certain amount, the four units of light reflected by the infield are below the threshold of vision; the infield looks black. This is brightness contrast.

Suppose we illuminate the infield by yellow light. This light again is at its best when the outfield is black: the infield looks yellow. If we now introduce yellow light into the outfield, the infield looks a darker shade of yellow. By further increasing the yellow light of the outfield a point is reached where the yellow light of the infield is below the threshold and looks black. This is saturation contrast.

If we illuminate the infield by a small amount of white light, it looks white as long as the outfield is not illuminated at all. If now we introduce red light into the outfield, the infield begins to look bluish green. By regulating the amount of red light in the outfield we reach a point where the infield (illuminated by the same amount of white light) looks a saturated bluish green. This is the first form of color contrast: the neutral color of the infield is changed to a chromatic color. And the color of the infield is always complementary to that of the outfield. By means of this mode of procedure it is possible to make the outfield appear any color. The only proviso is that we introduce into the outfield the color that is complementary to the color desired in the infield.

If we illuminate the infield by yellow light, it looks yellow provided the outfield is not illuminated at all. If we now introduce into the outfield light that is not complementary to the infield, say green light, the yellow infield becomes reddish. If we introduce red light into the outfield, the yellow infield becomes greenish. This is the second form of color contrast.

The importance of these phenomena can be gathered from the fact that it is impossible to avoid simultaneous contrast: in daily life there is always an outfield for every infield. The best we can do artificially is to regulate the illumination of infield and outfield, and this is done by his contrast box with greater precision by the instrument of Dr. Eber. In daily

life we get only the beneficial effects of simultaneous contrast. There are two such effects which need emphasis.

Hering has pointed out that without simultaneous contrast we should not be able to recognize visible bodies by their sensible qualities. Sunlight varies in intensity enormously from morning to noon, from day to day, from month to month, as every photographer knows. A piece of black coal reflects at noon about 50 times as much light as it does early in the morning, and about three times more light than a piece of white chalk does early in the morning. If, then, the sensation aroused by a piece of black coal depended only on the amount of light reflected by it, it should look white at noon, and whiter than chalk does in the early morning. As a matter of fact it does not: it looks about as black at noon as early in the morning. The reason for this is that the illumination of the outfield increases proportionately from morning till noon. This outfield stimulates the peripheral portions of the retina and inhibits the stimulating effect of the infield. It is for this reason that bodies in nature, a piece of coal, a rose, a green leaf, and so forth, have for us a "constant" color in spite of the enormous changes of daylight illumination.

Another beneficial effect of simultaneous contrast is that it makes visual acuity possible. The refractive media of the eye are far from being as perfect as the compound lens of a modern photographic camera is. In other words the best normal eye is slightly astigmatic. But we notice nothing of this "normal astigmatism." For the human eye has the marvelous capacity of correcting this "normal astigmatism" by the rivalry of adjacent retinal areas; that is, by simultaneous contrast. Only when astigmatism goes beyond the slight normal limits is it impossible to correct the defect by simultaneous contrast. And only such a degree of astigmatism is called by ophthalmologists "astigmatism," as they understand the term.

It may be possible to use the modified form of the contrast box as a means to detect color blindness, to distinguish the two types of ordinary color blindness, and to distinguish both from color weakness. So far, however, no data are available on this use of the instrument.

Those who wish further details concerning the phenomena of simultaneous contrast, and the correlation of these phenomena with the laws of color mixture, will find this information in Chapter IV of his "Experimental psychology."

Thermophore treatment of retinal detachment

Dr. Lawrence T. Post presented 13 cases of retinal detachment treated with the thermophore. Nine of these were surgically successful; that is, the retina was reattached. Previously he had used a different technique in two of these cases, without success. Four of the 13 patients were operated on by others in the Eye Department of Washington University. The method is by no means a cure-all but has certain advantages and is worth studying further. In order to reach far back with the thermophore, there must be a soft eye.

With regard to how much of the choroid and retina is affected by the application, he has made a number of sections of rabbits' choroids after applying the thermophore at temperatures of 160 degrees and 170 degrees for one and two minutes and has been surprised at the sharp-cut lines of reaction. The choroid and retina are cupped in the area of application where the adhesion is formed. Looking with the ophthalmoscope at the point of application of the thermophore there is a white, clean-cut area around which the retina and choroid look normal.

He has never made any section of muscle to which he has previously applied the thermophore. This paper will be published in full in the Journal of the Southern Medical Association.

Discussion. Dr. William Shahan recalled some 30 years ago seeing Dr. Hese using a hypodermic needle to draw out subretinal fluid. He said this was done only because he had to do something and not to cure the detachment. We are just now getting somewhere with treatment of detachments, mostly with diathermy. He has not had a great many cases of his own and he thinks the technique with the thermophore as yet is not perfected. Some cases respond without much surgery. The required temperature is usually from 160 degrees to 170 degrees. This does not produce a very violent reaction, nor much pain, and does produce a good result. In one case he simply applied the heat first and then made the puncture. Reattachment of the retina occurred and stayed that way for three months and then went to pieces.

Dr. Shahan showed his improved thermophore. The conductor in the new instrument will be rather large. In one end is a cylinder, solid brass, soldered in, and the thermophore will be inserted in that end. When using the thermophore at a temperature as high as 170 degrees for a long time, the body of the old thermophore becomes rather hot, so in this new model there is a second jacket placed around the inner jacket and the instrument will remain cool.

Dr. H. Rommel Hildreth reported the results of a laboratory study of the galvanic current as used for retinal detachment. Rabbits' eyes were punctured with the cathode needle, using one milliampere of current. A central puncture using no current was compared with a series in which the time of application increased from 1 second to 15. All the punctures appeared alike when examined histologically. At the time the current was applied there was a generous supply of hydrogen bubbles in the vitreous, indicating that the current was acting. From this study, which has been repeated, it would appear that the use of the galvanic current in the treatment of retinal detachment is of no value.

Dr. P. Luedde saw a boy who was injured a year prior to the first examination in June, 1937. At that time he had a macular hole and large flat detachment, so all that existed for visual purposes was the outer field. The thermophore was applied. The field was checked three or four days ago and he had a perfect field except nasally in the upper quadrant, where the thermophore was applied. The thermophore applicator was a 5-by-10-mm. point. The retina at present is entirely reattached.

Case reports

Dr. William F. Hardy read reports on the following subjects: 1. Bilateral symmetrical detachments of the retina in a juvenile; 2. Delayed reattachment of retina after operation on an aphakic eye; 3. Orbital hemangiectasia with marked proptosis; Removal with preservation of vision.

H. Rommel Hildreth,
Editor.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

May 24, 1938

Dr. J. Harley Harris, *presiding*

Foreign body in the eye

Dr. E. C. Ellett reported the case of Mr. E. D. M., aged 37 years, who was first examined on February 25, 1938.

On October 1, 1937, while at work driving a steel pin with a steel punch something struck the right eye. He received medical attention but no X-ray studies were made. The vision of the right eye was 5/10. The eye was slightly red. Tension was normal; the fundus appeared normal except for a few vitreous floaters. There was a small scar at the nasal edge of the cornea and under this a hole in the iris, seen by transillumination only. The X-ray film showed a foreign body in the right eye, 1 by 1 mm., 5 mm. below the horizontal, 0.5 mm. to the temporal side and 6 mm. behind the cornea. No trace of it could be seen with the ophthalmoscope or slitlamp.

The large magnet pulled the foreign body around the lens. It was drawn free of the iris and removed by a keratome incision upward without iridectomy. A silver spatula was passed into the anterior chamber and the foreign body was slid out along it, the spatula protecting the iris.

The patient went back to work April 18, 1938. Except for a small defect in the iris, down and another one in, and a few fine vitreous opacities, the eye is normal. Vision of the right eye is 5/4 —2 and J1.

Symblepharon

Dr. Phil M. Lewis presented a white man, 65 years of age, upon whom he had recently operated for a symblepharon of the lower lid, consequent upon a burn of the right eye 20 years previously. The adhesion extended from the lower fornix to the upper border of the pupillary space. Vision was reduced to the counting of fingers. The eye had been previously operated on in another city a year or two after the accident, but no improvement followed. Motion of the eye was very limited.

On April 21, 1938, the operation was performed. The growth was dissected from the cornea and sutured to the inner surface of the lower lid so as partially to line the raw surface. The conjunctiva was dissected up from each side but was found insufficient to cover the defect. Mucous-membrane grafts were cut from the lip and used to cover the raw area on the eyeball and the inner surface of the lid.

The vision is now greatly improved, but considerable corneal opacity remains. The lid is entirely free from the eyeball, so that motion of the eye is normal.

Malignant Melanoma—Subsequent Death from Metastatic Carcinoma

Dr. Phil M. Lewis reported a case of considerable interest which he had followed for a number of years. The patient was first examined in March, 1928, at the age of 57 years, because of headache following reading or sewing. She had a fairly high hyperopia with a small amount of astigmatism. Correction of this gave a vision of 20/20+ in each eye. The fundi were normal except for a moderate degree of sclerosis of the retinal vessels. In August, 1929, she returned complaining of headache and a burning of her eyes. Vision was found to be normal and her glasses required no change. The retinal vessels showed considerable sclerosis, and on taking her blood pressure it was found to be well over 200. She was referred to her physician for treatment.

In May, 1931, she returned complaining that her vision was failing, especially for close range. Proper correction gave normal vision for distance and for near. Seven months later, in December, 1931, she returned because the vision of her right eye was getting very poor. Examination revealed a bullous retinal detachment of the upper, inner quadrant. No tear was found. Tension was 23 mm.;

transillumination was negative. A Gonin ignipuncture was performed and while some improvement was noticed temporarily, the vision soon became worse, and the detachment more extensive. This process continued through 1932 and 1933.

In March, 1934, the eye was found to be completely blind, and she stated that it had been blind for several months. The retina was completely detached and tension was normal to fingers. The eye was not transilluminated as no thought was given to the possibility of an intraocular tumor. In November, 1934, she came in reporting redness, swelling, and pain for the past two days. The eye was found to be very hard, the tension being 70 mm. (Schiötz). Transillumination was good below and nasally, which included the area involved by the original detachment. The upper outer quadrant failed to transilluminate. Enucleation was performed a few days later and a glass ball was implanted.

The eye was sent to the Army Medical Museum at Washington, and Lt. Col. George R. Callendar reported it to contain a malignant melanoma. No X-ray therapy was given. The patient was seen several times during 1935, 1936, and 1937. No recurrence was ever noticed.

In September, 1934, the patient had a panhysterectomy, but the uterine tumor which was present was found to be a myoma. Three years later she was found to have a squamous-cell carcinoma of the vagina which was quite extensive and could not be entirely removed. She was at that time 67 years of age and in bad general condition, having a severe arteriosclerosis with hypertension. She died in March, 1938, of a generalized carcinomatosis. There was no evidence of a tumor in the orbit.

Retinoblastoma with metastasis

Dr. J. Wesley McKinney reported the case of A. H., aged five years, whose left eye had been enucleated 13 months ago on account of retinoblastoma. The tumor had shown early invasion of the optic nerve, but the nerve had been sectioned well behind the growth.

One month ago the mother noticed on the right shoulder blade a knot which has gradually enlarged. X-ray showed widespread erosion of the scapula. Examination of the socket showed no evidence of local recurrence and with dilated pupil there was no sign of tumor in the other eye. A biopsy was taken from the scapula tumor. The pathologist reported the tumor to be made up of cells identical with those in the ocular tumor. The tumor is at present being treated with X-ray therapy.

The question arose as to whether this might not be a Ewing's tumor, but it was the consensus of the pathologists who examined the slides that, although the microscopic picture did resemble Ewing's tumor, this was a metastatic retinoblastoma. In the latter case it is certainly unusual that a retinoblastoma should metastasize after one year without local recurrence.

Discussion. Dr. E. C. Ellett recalled only one similar case in which the eye was removed for retinoblastoma and about a year later a mass was found on the left ulna which was diagnosed Ewing's tumor.

J. Wesley McKinney,
Secretary.

OXFORD OPHTHALMOLOGICAL CONGRESS

The Oxford Congress for 1938 was held July 7, 8, and 9. On July 16 the Lancet published a good account of the Congress. This contrasts strongly with the usual neglect shown by general medical journals to scientific meetings dealing

with diseases of the eye. The proceedings of this Congress in full will be published in the Transactions of the Ophthalmological Society of the United Kingdom, some time in 1939.

Ocular palsies

Prof. Cairns, of Oxford, reported that ocular palsies result chiefly from pressure, or stretching of the nerves in the cranium or in the orbit. Their clinical manifestations depend on the progress of the causative lesions. Orbital abscess paralyzes all the external ocular muscles, partly or completely. Evacuation of the abscess brings prompt recovery. Benign tumors of the orbit disturb the ocular movements but little. Palsies are often the first noticed symptoms of malignant tumors. Metastatic tumors of the roof of the orbit cause diplopia with pain. Ophthalmoplegia with exophthalmos may follow thyroidectomy, or may develop without thyroid disease. Such palsies may arise from carotid aneurysm, tumors of the middle fossa, cyst of a sphenoidal sinus, cranial polyneuritis, tumor of the Gasserian ganglion, or lipoid deposits in the bones of the skull. These cases must be studied by modern methods, including radiography of the bones, ventricles, and arteries.

Cataract

Prof. A. von Szily, former Director of the Eye Clinic of Münster, Germany, gave the Doyne Lecture. He took up the pathological examinations and morphologic findings, and the contributions of embryology, biomicroscopy, and biochemistry to our changing views about the lens. Histological slides showed displacement of the nuclear corona, and other features of abnormal development. He traced the development of punctate, lamellar, and nuclear cataracts. Calcium deposits are the most common of chemical changes in cataract. Cholesterin crystals are found less often. Lack of vitamin C influences the production of cataracts. Lens tissue is especially sensitive to intermediate products of metabolism.

Contact glasses

Mr. F. A. Williamson-Noble, of London, said only recently had it been possible to produce contact glasses that could be worn with comfort by many people. The indications for contact glasses were optical, occupational, and cosmetic. Conical cornea, high myopia, after effects of mustard-gas burns, nebulas and facets of the cornea, any surface irregularity in the pupillary area of the cornea, may produce interference with vision that cannot be remedied by ordinary glasses. But the filling in, by saline fluid, of the space between the cornea and the glass, could produce great improvement of vision. Some patients reported discomfort during the first hour of wearing them; after which they became progressively more comfortable. Of myopic patients tested, 60 percent could wear contact glasses for six hours or more.

Intracranial and intraocular pressure

Prof. Hans Lauber, formerly of Vienna, now of Warsaw, spoke on the relation between intracranial and retinal blood pressure and intracranial tension. The relation between retinal venous and arterial pressure varies between 1 to 1.8 and 1 to 3. So long as this normal relation is preserved no papilledema occurs, in spite of high arterial pressure. He described the influence of low arterial pressure in accelerating the progress of optic-nerve atrophy. He pointed out that the circulation in the retina, differs from that in the tissues because the intraocular tension acts on the vessels, especially on the capillaries. If the difference between

diastolic blood pressure in the retinal arteries and the intraocular pressure is less than 20 mm., nutrition of the retina is impaired; especially the oxygen supply is insufficient. This is illustrated in glaucoma and in tabetic optic atrophy, Leber's disease, and retinitis pigmentosa, in which low blood pressure is often found. In such conditions the arterial pressure should be raised and the intraocular pressure kept down by pilocarpine, or by cyclodialysis.

PAPILLEDEMA

DR. VAN HEUVEN, of Utrecht, had checked the relations between venous pulsation seen with the ophthalmoscope and intracranial pressure, and found lack of venous pulsation to be an important sign of early papilledema. The colloid chemical conditions of the optic nerve and surrounding tissues also influence the development of papilledema. He referred to Prof. Lauber's observation that compression of the vein, but not of the artery, causes rapid development of papilledema.

ANESTHESIA OF OPHTHALMIC SURGERY

MR. H. M. TRAQUAIR, of Edinburgh, opened a discussion of this subject. He reviewed the development of the technique for securing local anesthesia for eye work. Total anesthesia has now been achieved by injections around the lids, applying cocaine to the eye, and subconjunctival injections above and below the cornea.

GLAUCOMA

MR. HARRISON-BUTLER illustrated detachment of the zonular lamellae of the lens, in what he called capsular glaucoma. Otto Barkan, of San Francisco, found that the angle of the anterior chamber was often blocked in glaucoma, and that shreds of capsule might often be found there. Mr. Ridley, of London, called attention to a substance in the tears similar to histamine. It caused a rise of intraocular pressure, through vascular dilatation.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

March 11, 1938

DR. WALTER CAMP, *president*

HEADACHES OF OCULAR ORIGIN

DR. A. D. RUEDEMANN of Cleveland gave a talk on this subject.

Discussion. Dr. A. D. Prangen said it is important to see that the patient has a thorough physical, and possibly a neurological, examination in a search for all the possible factors which might be causing the headaches. In cases of chronic headache of doubtful origin it seems best that some one consultant be made a sort of clearing house for all the clinical data and that he make an attempt to put the various component parts of the clinical picture together in an attempt to establish a diagnosis.

Dr. A. D. Ruedemann in answering Dr. Fink regarding children and their headaches said the child himself must be considered. He may belong to a social group in which headaches are common or he may come from more or less inferior stock. Such a child comes in contact with normal individuals and is expected by his parents to carry on as a normal child. We must remember that headache is foreign to the child as he starts out in life and someone must impart to him the idea of headache.

George E. McGeary,
Secretary.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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PLASTIC SURGERY OF THE EYES

The eye is the feature most observed in the face. Its perfection in appearance, movement, and expression, is most important to the pride, self confidence, and economic and social well-being of its possessor. The cosmetic effect must be thought of in connection with every plastic operation, considered and advised to be done on the eye, or the parts visibly related to it. The danger of untoward cosmetic results may influence the conscientious surgeon to avoid doing or advising operation. Even a squint operation or a cataract extraction may have unpleasant cosmetic sequels for both surgeon and patient.

When an operation should be done to correct a cosmetic defect from injury, poor repair, cicatricial deformity of trauma, or disease, the ophthalmologist may feel lack of experience in just that kind of operation, so that he hesitates to do it or advise it—although apart from his interest in the patient's welfare, and his own reputation, he may feel that something of the kind is clearly indicated and might properly be done.

The plastic surgery of the eye is likely to be a specialty within the specialty. The surgeon who has had large experience in ophthalmic surgery knows how easily operative results may be disappointing and feels he is in more danger of blame for what he has done than for what he has left undone. He is not likely to begin doing operations of this kind in the hope

of developing skill that will justify his efforts and risks. Plastic operations are more likely to be undertaken by young operators who have seen successful results in the practice of their teachers and who feel they have had the preparation to meet the difficulties and obstacles that beset plastic surgery.

Those who have seen the work and the results achieved in this field by John M. Wheeler, will feel that his untimely death was indeed an irreparable loss. His developed judgment and manual dexterity as well as his large experience gave him a fitness for this work that very few can hope to attain. Nevertheless such work must be done, and it is to the interest of all ophthalmologists that it be done in the most expert manner.

To be fitted for plastic surgery of the eye, one must have a clear and fresh knowledge of the minute anatomy and physiology of the eye and adjoining structures. An operation always changes somewhat the relations of the parts involved, and may so change the nerve and vascular supply as to impair cell life. The skin, mucous membrane, cilia, tarsal tissues, movements of the lids and eyeballs, even the tissues of the nose, and the walls of the orbit, must be considered in plastic surgery, both with regard to their normal anatomy and their physiologic processes of repair. Corneal replacement by grafting is a new branch of plastic surgery. Glaucoma still presents unsolved surgical problems. The nutrition of the transparent tissues of the eye is different from that of all other animal tissues, in ways not well understood.

The maintenance of the curves of the dioptric surfaces and their relation to the retina is a necessary condition of good vision. How these relations are maintained is imperfectly understood. So that any operation on the eyeball is a venture in the dark. The cosmetic effects of ophthalmic operations are too important to be ignored, and too uncertain to be disregarded. The updrawn pupil of intracapsular cataract extraction, should give us pause until it is better understood. Cosmetic effects may be thought unimportant; but their implications may be serious. Plastic surgery seeks to improve the condition of living tissues. The experience of the surgeon who does it is of high importance to the ophthalmologist.

Edward Jackson.

CONJUNCTIVAL PEMPHIGUS

There are probably many ophthalmologists who have never seen a case of conjunctival pemphigus. The condition is rare even in the clinic. Textbooks have little to say about it, the statement being usually limited to a brief description of its essentially atrophic character, with some allusion to rarity, obscurity, and hopelessness.

Essential shrinking of the conjunctiva has been classed as a closely related condition, if not actually identical with pemphigus. Both disturbances tend gradually, sometimes in the course of many years, to contraction of the conjunctival sac, formation of adhesions between conjunctiva and cornea, and serious loss of vision. The distinction between the two, so far as any difference certainly exists, lies in the fact that the lesions of conjunctival pemphigus are more or less generally regarded as beginning with the formation of blebs, whose rupture is followed by development of scar tissue. A number of writers, however, have suggested that such blebs probably existed in the cases of essential shrinking but escaped notice on account of the slow and insidious course of the disease.

As regards the general skin and mucous-membrane surfaces of the body the term "pemphigus vulgaris" is applied by der-

matologists to a disorder accompanied by blebs on the skin or mucous membrane. Its differentiation from herpes, urticaria, eczema, drug eruptions, and so on is more or less difficult but depends to some extent upon an exaggerated tendency of pemphigus blebs to break down, leaving moist defects, which in the more severe types are followed by deep inflammation, tissue destruction, and scar formation.

As bearing upon the question of identity between pemphigus and essential shrinking of the conjunctiva, Franke, who assembled 107 cases from the literature, found that one tenth of the cases of essential shrinking had a record of pemphigus in another part of the body.

The appearances encountered in ocular pemphigus are manifestly influenced by local anatomic and secretory conditions. The constant flow of tears, and the movements of the lids and globe, favor maceration and probably increase the liability to secondary infection and the formation of granulation tissue. Symblepharon arises from adhesion between two superimposed areas of erosion.

The few attempts made to explain the nature and causation of this destructive process must be described as unsuccessful. Intestinal toxins and endocrine or general nervous derangement have been incriminated, and more recently there has been some disposition to attribute the disease to a living virus. The fact that conjunctival scrapings, and also the contents of the epithelial blebs, show eosinophilia has been thought to suggest an allergic basis.

A careful analysis of the pathologic processes involved is offered by Meyer (Klinische Monatsblätter für Augenheilkunde, 1938, volume 101, page 708), his material being two cases seen at the Freiburg clinic and an old specimen from the Axenfeld collection. In the first clinical case, under observation for thirteen years, there had for ten years been some doubt as to the diagnosis. In the second patient, in the course of "essential shrinking of the conjunctiva," there were bleb formations on the mucous membrane of the palate and larynx, and the skin also became involved.

The old excised piece of conjunctiva which Meyer was able to study showed a chronic inflammatory process, with development of abundance of young connective tissue. The epithelium had completely lost its mucous character, and there were no goblet cells. There was some evidence in favor of Kreibich's view that the pemphigus bleb develops on the basis of preëxisting inflammation.

In common with reported cases of pemphigus foliaceus of the skin, the specimen showed flat epithelial elevations (rather horizontal gaps than blebs), lamellar exfoliation, marked infiltration of the cutis with round cells, thickening of the epithelial layer, granulation and proliferation, and secondary cicatricial shrinkage.

In the first of the two clinical cases, severe exacerbations alternated with remissions of as much as several months during which no discomfort was experienced. Definite bleb formation was encountered only once in the whole course of the disease, but denuded areas, frequently seen, were regarded as representing the remains of very fugitive blebs.

In the second patient, a man 82 years old, the existence of the condition could be traced back for only two years. The case was a typical one of essential shrinking of the conjunctiva, without any suggestion of bleb formation. As to both conjunctiva and skin, the process was of the malignant and persistent type involving the deeper layers. Although tubercles were encountered in the affected tissue, with epithelioid and giant cells, central necrosis, and infiltration by lymphocytes,

attempts to demonstrate tubercle-bacillus infection were entirely unsuccessful and there was no clinical evidence pointing to such an etiology. In place of bleb formation the epithelium displayed a pronounced tendency to exfoliation.

In attempting palliative treatment of conjunctival pemphigus, one must not be misled by the spontaneous remissions, which may last sometimes for years. One exception only seems possible to the general statement that treatment is practically useless. In the former of the two clinical cases described by Meyer, four plastic operations were successfully performed for the relief of trichiasis and entropion. These operations arrested corneal ulcers which had been induced by the trichiasis, although (it is interesting to observe) there was subsequently distinct evidence of bleb formation on the healed transplants. This is an excellent illustration of the fact that surgical ingenuity may often prove beneficial even in fundamentally incurable conditions.

W. H. Crisp.

GIZA LABORATORY REPORT

This twelfth annual volume for 1937 is similar to its predecessors and of like excellence. The group forms an interesting and valuable collection. It is unfortunate that more organizations cannot publish similar reports. The major difficulty lies in the expense of the project.

Many interesting pathological and clinical cases are given; among them is one of bilateral multinodular episcleritis, supposedly tuberculous, which was cured by tuberculin injections. Two cases of Eales's disease in brothers are reported.

The research section, is as usual, excellent. The work on trachoma has been continued. Giza is undoubtedly one of the most important centers in the world for this study, and anything emanating therefrom must be given serious consideration.

Among the sections that will catch the eye of the reviewer is the experience with sulfanilamide chemotherapy in trachoma. Ten children with active trachoma and pannus—but not secondarily infected—were treated as outlined by the United States Public Health Service. The drug appeared to have no effect on the disease. This is in line with the findings of many observers in the United States. Though there is a truly remarkable improvement in cases of trachoma which have been secondarily infected, the sulfanilamide having cleared up the secondary infection there does not seem to have been much good done for the disease itself.

The uselessness of extract of adrenal cortex in chronic simple glaucoma was demonstrated as anticipated in a small series of cases.

The section on spring catarrh is especially interesting and well done. It is beautifully illustrated in black and white and in colors. The mechanics underlying the various appearances are clearly explained; anatomical arrangements seemingly lie at the basis of these. A capillary leakage with collection of exudate and then absorption more or less paralleling it take place. The picture differs in different regions because of the varying anatomy. In the palpebral type the epithelium is exhausted because the leakage is too rapid for all of it to be successfully passed through the epithelium. Broad papillae are formed which gradually become vascularized, and the characteristic "cobble stones" are formed. The unreliability of trusting to the finding of eosinophilic cells as a differential point, at least in Egypt, is again brought out. In from 60 to 70 percent of hospital patients eosinophiles were found in the conjunctival secretion. This may be due to the prevalence of intestinal parasites in the native population. The better test suggested is that the pal-

pebral conjunctiva be dried and exposed to the air for a few minutes, following which a thin glistening tenacious membrane will form in cases of vernal catarrh.

Many cases have been studied and the author presents a very convincing thesis. The reader cannot fail to want to confirm these slitlamp findings in his own patients.

These Reports are well prepared, valuable, and should have a wide circulation.

Lawrence T. Post.

BOOK NOTICES

AMERICAN RECOMMENDED PRACTICE OF SCHOOL LIGHTING. American Standards Association, New York. Paper bound, 60 pages, 39 illustrations, 1938. Price 25 cents.

The practice recommended in this pamphlet may not be ideal but it is decidedly an advance on the lighting now used in the great majority of schools. A single illustration in it, showing the difference between indoor daylight and that which we live in out-of-doors, will be worth more than the price to any one who thinks about the health of children, or the need for good light in schools. The book has been prepared under the joint sponsorship of the Illuminating Engineering Society of New York and the American Institute of Architects of Washington, D.C. It is arranged in four parts: 1. Lighting and education. 2. Factors which affect lighting and seeing. 3. Natural lighting of schoolrooms. 4. Artificial lighting of school rooms. The last part occupies more space than the other three and has more than five sixths of the illustrations. This, and the fact that a Part 5 (three pages) is devoted to Wiring, may give the impression that the book is simply intended to serve the interests of those who sell electric power and fixtures. But in spite of this, it should be known to all who are interested in the vision and health of school children.

The one illustration above alluded to, shows, on one page, reproductions of three photographs: one of a playground at noon taken by 10,000 foot-candles of daylight; the second a group of school children outdoors in light ranging from 450 to 700 foot-candles; the third taken in the school-room by natural light, in which the illumination ranged from 240 foot-candles in the window, to 8 foot-candles on the desks at the opposite side of the room. Architects have made such poor use of natural daylight that some provision of artificial light is needed in almost every schoolroom.

It is encouraging to find that the part on "Natural lighting of schoolrooms" begins with a discussion of "orientation of building." Architects have heretofore been given the impossible task of providing for natural lighting in buildings from which daylight was shut off by trees and higher buildings around them. In these days when, in the heart of large cities, high and costly buildings are being torn down to provide parking spaces, because that use would give the best return to the owners of the ground, it should be possible for any school board, holding the ideal of a balanced budget, to provide for natural light by surrounding each school building with parking spaces. The future growing appreciation of the child's need for light and physical development, will bring an understanding to school boards and tax payers that every school should be surrounded by playgrounds. The regular exercises, using the proper apparatus and games for the different grades of children, will increase the value and efficiency of the school more than anything that can be put into the indoor school curriculum.

Every ophthalmologist can profitably read and consider the things set forth in

this book. It will give him new light on the importance of exact correction of errors of refraction, and the balance of ocular movements. The traditions and history of operative ophthalmology, and the importance of hospitals and asepsis, newly discovered, overshadow and obscure the supreme importance of visual function in our present civilization.

Edward Jackson.

BULLETINS ET MEMOIRES DE LA SOCIÉTÉ FRANÇAISE D'OPHTALMOLOGIE. Volume 51. 647 pages. Paris, Masson et Cie, 1938.

This annual volume records the presentations made during the meetings held May 16-19, 1938. A total of 43 communications was offered, and they cover a number of different subjects, although the majority are devoted to therapeutic and surgical methods in use for various ocular manifestations. While certain reports will have special appeal for different readers, the volume forms *in toto* an interesting and readable collection. Because of the number and diversity of the individual papers, it is difficult to render them into adequate résumés. The meeting of May 18th was devoted to what might be termed a symposium on cataract, eight different reports being given over to this subject.

It is particularly gratifying to see the adaptation to ophthalmological problems of newer experimental procedures developed in other fields. Thus, a paper by Tillé, Pillet, and Busnel on micro-incineration and tissue spectography presents a new approach to the problem of cataract formation. These newer methods reveal, for example, that while normal crystalline and the amber senile cataract contain neither iron, copper, nor zinc, the white senile cataract contains only copper, and the black cataracts of either spontaneous or traumatic origin contain both copper and iron.

L. A. Julianelle.

GIZA MEMORIAL OPHTHALMIC LABORATORY, Twelfth Annual Report, 1937. Paperbound, 168 pages, 67 illustrations, some in color. Printed by Schindler's Press, Cairo, 1938. Price P.T. 35.

See editorial "Giza Laboratory report," page 443.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Busigin, H. V. **Another type of ophthalmoscope.** Viestnik Opht., 1938, v. 12, pt. 4, p. 523.

The author has designed an ophthalmoscope attached to a headband, thus leaving the hands free.

Ray K. Daily.

Goldman, Hans. **The technique of slitlamp microscopy.** Ophthalmologica (formerly Zeit. f. Augenh.), 1938, v. 96, Nov., p. 90.

The author describes accessories to the slitlamp that simplify several complex procedures. For examination of the fundus, he places a prism in the path of the beam after it leaves the distal lens. By double reflection from two of the surfaces of the prism, the angle between the axis of illumination and of observation is reduced to 5°. When the patient wears a very light contact glass made of a glass substitute, the fundus and the posterior parts of the vitreous can be conveniently examined. For gonioscopy of the entire chamber angle with the patient seated at the slitlamp, the author has devised a similar light contact-glass. Its anterior surface is flat and it has embedded in it a totally reflecting plane surface which lies at an angle of 64° with the anterior plane. By rotating the glass about its axis all parts of the chamber angle can be brought successively into view. For illumination, the slitlamp is used with the special deflecting prism.

F. Herbert Haessler.

Streiff, E. B. **Adaptation of the Nordenson apparatus to keratoscopy and to photography of the anterior segment of the eye.** Ophthalmologica (formerly Zeit. f. Augenh.), 1938, v. 96, Nov., p. 84.

By replacing the +0.75 D. lens in the Recross disc with a +2.25 D. lens, very acceptable photographs of the lids and the anterior segment of the eyeball may be made. By putting a +16.00 D. lens in place of the color filter, vitreous opacities may be photographed. A

translucent Placido disc, 40 cm. in diameter, with four lamps behind it mounted on the distal end of the horizontal tube, converts the instrument into an adequate photokeratoscope.

F. Herbert Haessler.

Viallefont and Lafon. **Entopic pupilloscopy; spontaneous variations of the pupillary diameter.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 378-381. (See Amer. Jour. Ophth., 1939, v. 22, Feb., p. 226.)

Zamenhof, Adam. **A small illuminator for campimetry.** Klinika Oczna, 1938, v. 16, pt. 5, 592.

The author describes a handlight which projects a circle of light on the campimetric screen. (Illustration.)

Ray K. Daily

2

THERAPEUTICS AND OPERATIONS

Allen, J. H., and Braley A. E. **Staphylococcus toxin.** Amer. Jour. Ophth., 1939, v. 22, Jan., pp. 11-15.

Glover, L. P. **Some uses of sulphanilamide in ophthalmology.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 180-184.

Goar, E. L. **Management of the complications of intraocular surgery.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 62-68.

A discussion of prevention and treatment of the complications of intraocular surgery. Goar prefers iridencleisis to trephining in glaucoma and gives his technique. (3 references.)

Ralph W. Danielson.

Green, J. **The conjunctival flap in ophthalmic surgery.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 69-77.

Green discusses the use of the conjunctival flap not only in removal of cataracts but also in the following: (1) rupture of wound after extraction of lens, (2) various complications of trephine operations, (3) keratoplasty, (4) progressive ulceration of the cornea, (5) for covering a shrunken, blind eye to make a bed for prothesis, (6) gonorrheal ophthalmia, to prevent ulceration of the cornea. (21 references.)

Ralph W. Danielson.

Jacqueau, M. **Very long and extensive use of shock medication by intravenous injections of electraurol.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 273-277.

For eighteen years the author has used electraurol intravenously as a means of shock therapy, to the exclusion of all other methods. He estimates that a total of 3,000 injections have been administered. The usual doze was 3 c.c. The indications for use are disturbances following cataract operations, iritis with hypopyon, late intraocular infection following sclerectomy, traumatic perforation of the globe, sympathetic ophthalmia, and infectious or inflammatory states generally.

Clarence W. Rainey.

Kapuscinski, W. J. **Typhoid vaccine in ocular therapeutics.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 277-293.

The author considers that typhoid vaccine acts chiefly by the increased temperature that it produces, and considers it in the same category with hyperthermia induced by other means. He uses a vaccine prepared by the Institute of Hygiene of Warsaw, which has a uniform and constant bacterial count of 1 billion per c.c. The initial dose of 0.01 c.c. is given intravenously. If the temperature does not rise above 39°C., a second dose of 0.03 c.c. is given the day following fall of the temperature induced by the first dose.

Usually a temperature of 40°C., is obtained within four to six hours after the second injection. The injections are given in a series of ten to twelve. A fever of 40°C. should follow each injection. If the patient is not sensitive to the injection the dose is doubled for the following injection. If the patient is oversensitive to the injection, the dose is reduced by a third. The injections are made in the morning, the peak of the temperature rise occurs in the early afternoon, and by evening the patient has a normal temperature. The author reports his results in treating cases of sympathetic ophthalmia, interstitial keratitis, herpes zoster of the cornea, gonococcal conjunctivitis, juvenile recurrent hemorrhage into the vitreous, and retrobulbar neuritis. For tuberculous uveitis, he prefers typhoid vaccine to the use of tuberculin.

Clarence W. Rainey.

Karbowski, M. **Iontophoresis with adrenalin in ocular therapeutics.** Acta Ophth. Orientalia, 1938, v. 1, Oct., p. 9.

Iontophoresis is, according to the author, an easily applicable and harmless method of treatment, and should be used to a greater extent in ophthalmology, especially since it opens new ways of treatment of the anterior and posterior segments of the uvea, the retina, and, perhaps, the lens and vitreous. Adrenalin iontophoresis, while it is as effective as subconjunctival injection, has the additional advantage of not affecting the general circulation.

R. Grunfeld.

Laval, Joseph. **Vitamin therapy in ophthalmic practice.** Amer. Jour. Ophth., 1939, v. 22, Jan., pp. 33-37.

Lemoine, A. N. **Hyperpyrexia in the treatment of ocular syphilis.** Arch. of Physical Therapy, 1938, v. 19, Nov., p. 675.

Cases of syphilitic interstitial keratitis, optic neuritis, secondary optic atrophy, primary optic atrophy, and chorioretinitis were treated by hyperpyrexia, induced either by tertian malaria or the hot bath. Results obtained by the use of the hot bath were as good, though not so rapid, as those obtained by malarial parasites. Clearing of salmon patches and corneal opacities in interstitial keratitis, and subsidence of the acute reaction in neuroretinitis, were considered to be more rapid than in other forms of treatment. Primary optic atrophy seemed to be arrested, and vision and fields improved in some instances. George A. Filmer.

Spaeth, E. B. **A review of some modern methods for ophthalmic plastic surgery.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 89-100.

The author appreciates that most of the contents have been published before in various texts and monographs, and also that considerable important detail is not here included. The article is, however, presented as a convenient abstract of some of the principles which underlie ophthalmic plastic surgery.

Ralph W. Danielson.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Berner, G. E., and Berner, D. E. **Reading difficulties in children.** Arch. of Ophth., 1938, v. 20, Nov., pp. 829-838.

The modern method of teaching reading by sentences, while it produces rapid and intelligent readers, taxes to the limit the child's powers of attention and concentration. Because of the high degree of visual attention re-

quired, certain minor defects of less importance under older methods have now become significant. Besides gross visual defects, the factors responsible for most reading difficulties are: visual immaturity, low hyperopia, deficient fusion, and deficient fusional convergence. The authors discuss these factors and point out methods of correcting them. J. Hewitt Judd.

Bettman, J. W., and McNair, G. S. **A contact-lens telescopic system.** Amer. Jour. Ophth., 1939, v. 22, Jan., pp. 27-33.

Bietti, Giambattista. **Researches on the mechanism of action of sympathotrope substances on the light sense.** Boll. d'Ocul., 1938, v. 17, April, pp. 279-306.

Different persons having normal eyes or affected by retinitis pigmentosa were tested to find out how their light sense was affected by sympathetic-stimulant drugs such as adrenalin and sympathetic-paralyzing drugs such as lymphoganglin and ergotamin. The conclusions are given in tabulated form. Conjunctival instillation of the first group of drugs is followed by deterioration of light sense. Improvement accompanies the action of the other group of drugs.

The first group of drugs, subcutaneously administered, it is not usually followed by deterioration of light sense, but sometimes even by improvement. Experiments on frogs indicated that the first group of drugs caused, in retina kept in the dark, migration of retinal pigment along the rods and cones toward the external limiting membrane in the "light" position. The second group of drugs, on the other hand, tended to cause migration of the pigment exposed to light toward the pigmented epithelium, that is, the "dark" position. The experiments with adrenalin showed, however, that the improvement of the light sense was only partly due to migration of the retinal pigment, and that a notable part was played by the vascular factor. Injections of the adrenalin group were followed by vasodilatation in the region of the central artery of the retina, and this mechanism is taken to explain the improvement of light sense obtained with such medicaments after subcutaneous injection.

Melchiore Lombardo.

De' Cori, Renzo. **Sphygmic oscillations of corneal curvature.** Boll. d'Ocul., 1938, v. 17, March, pp. 153-162.

The right eye of a woman of eighteen years was found with the exophthalmometer 1 mm. more prominent than the left eye and to be affected by compound direct myopic astigmatism. During examination with the ophthalmometer the cornea of this eye showed rhythmic changes, its horizontal curve varying from 55 to 55.25 D. and the vertical from 58.5 to 59.25 D.; that is, the radius of the horizontal meridian was shortened from 6.1 to 6.07 mm. and the vertical from 5.75 to 5.68 mm. These changes were synchronous with the pulse, the maximal value appearing during systole, when the astigmatism increased 0.5 D. The article closes with a discussion of probable factors. (Bibliography.) Melchiore Lombardo.

Eames, T. H. **The speed of picture recognition and the speed of word recognition in cases of reading difficulty.** Amer. Jour. Ophth., 1938, v. 21, Dec., pp. 1370-1375.

Essen, Jac. **The quality of darkness.** (Answer to Ohm.) Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 817-838.

Essen answers that Ohm could not have understood his original paper, since Ohm insists that darkness is objectively the absence of light (see p. 453.) Essen explains that he is an investigator in psychology, occupied with the principles of sensory perception and experience in sight and hearing. He is also occupied in physiologic research. Obscurity or darkness is not of a physical nature but an optical sensory perception and is not the opposite of brightness but of the optical sensory perception of clearness. Obscurity or darkness is an absolutely photic experience in which the aphotic factor or the perception of black prevails. Lack of optical differentiation signifies both failure to perceive visible objects in the visual field and exclusion from the real world of sensory experiences. The phenomenon of blindness is psychologically as well as physiologically associated in the narrowest sense with that of obscurity or darkness. Blindness is the particular experienced form of obscurity or darkness. H. D. Lamb.

Granit, R., Holmberg, T., and Zewi, M. **On the mode of action of visual purple on the rod cell.** Jour. of Physiology, 1938, v. 94, Dec., p. 430.

Measurements were undertaken in dark-adapted eyes of frogs to determine the relationship between the size of the retinal electrical response and the total quantity of visual purple present when the eyes were subjected to a constant test light of wave length 0.500 micra. It was found that the quantity of visual purple in these eyes remained the same as in control eyes, although the retinal electrical response was reduced one third to one half by adaptation. These results were particularly interesting in view of the fact that the retinal electrical response is known to increase during regeneration of visual purple. The authors suggest a hypothesis to account for the apparent discrepancy. George A. Filmer.

Hawes, R. T. M. **Notes on dark adaptation and a single instrument for its investigation.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 103.

The author describes an instrument which he has devised as an attempt to eliminate certain inherent errors in some of the previous instruments for determination of dark adaptation. The tube is completely illuminated, so that the whole retina is bathed in light during the bleaching period. The test object is an arrow which can be moved in any direction without the knowledge of the observer and the illumination is controlled by polaroid discs so that definite percentage and very smooth diminution in the light illuminating the arrow are possible.

Three series of experiments are summarized; (1) as to the number who saw the arrow illuminated by 60 percent of the available light at varying times after the bleaching light was extinguished; (2) for determining whether familiarity with the instrument altered the findings; and (3) the effects of administration of vitamin A in halibut-liver oil on eleven of the worst subjects. Beulah Cushman.

Karbowski M. **The pathology of color perception.** Graefe's Arch., 1938, v. 139, pt. 3, p. 480-502.

The disturbances of normal perception of color located in the eye are divided into those due to opacities in cornea, lens, anterior chamber, and vitreous and those due to changes in the function of the retinal cones. Any

diminution in the transparency of the ocular media causes exclusion of the rays at the blue end of the spectrum. Changes in the function of the cone include paresis, paralysis, or spastic contraction of the myoid in the inner portion of the cone. In both instances, only one platelet in the outer portion of the cone, corresponding to a single color, can under such conditions come into the focus of the light rays. Thus the erythropsia and red and green blindness of the snow-blind are explained. Nutritional disturbances or toxic influences may influence color vision by changing the absorptive capacity of the color-sensitive cone and the ability of the physical stimulus to change to nervous energy. A smaller part of the blood supply to the cones comes from the retinal blood vessels. Accordingly, in all forms of choroiditis, choroidal tumor, choroidal tear, choroidal detachment, retinal detachment, and myopia, the violet and blue rays perceived by the platelets at the tip of the cone are first affected, whereas the red and orange rays perceived by the platelets at the base of the outer part of the cone are less disturbed. In addition, the fact that blue is also poorly distinguished in degenerative disorders of the retina, such as hypertonic, nephritic, diabetic, tuberculous, and syphilitic retinitis, together with pigmentary degenerations of the retina, would indicate that in all these conditions the etiologic factor comes from the choroid. On the other hand, when the nutrition from retinal blood vessels is concerned, recognition of red is first disturbed. This would occur in early inflammatory and degenerative processes of the second and third neurons of the retina. The primary cause might be spasm or embolus of the retinal arteries, passive hyperemia, or thrombosis of the retinal veins. It could be an early differential symptom in multiple sclerosis, pituitary tumor, or retrobulbar neuritis but is also present in optic atrophy from glaucoma, from embolus of the central retinal artery, and from tabes. Changes in the visual fields for red may be either contraction, quadrant hemianopsia, central or paracentral scotoma, or homonymous or heteronymous hemianopsia. H. D. Lamb.

Kolačny, J. **Disturbances of liver function and their relation to reduction of dark adaptation.** Bratislavske Lekarske Listy, 1938, v. 18, Oct., p. 63.

Systematic adaptometric studies on patients with clinically recognized disturbances of liver function yielded in every case a reduction of ocular adaptation for darkness. Hemeralopia, however, was only manifested in a few cases, and was usually latent, the patient knowing nothing of its existence, and the hemeralopia being indicated merely by the adaptation curve. The author assumes that the hemeralopia existing in these cases is to be regarded as a consequence of disturbed rate of regeneration of the visual purple, caused by a deficiency in vitamin A. Such deficiency arises from disturbances of function in the liver, where the transformation of carotin into vitamin A takes place. Thus in cases in which disturbance of liver function is merely presupposed (but cannot be confirmed by existing clinical methods) the hemeralopia is to be regarded as an early symptom of this disturbance. After administration of vitamin A in the cases here reported, an improvement in adaptation was demonstrated adaptometrically. W. H. Crisp.

Kravkov, C. V. **The relation of visual acuity to illumination.** Viestnik Opht,

1938, v. 12, pt. 4, p. 525. (See Amer. Jour. Ophth., 1938, v. 21, Dec., p. 1407.)

Lancaster, W. B. **Aniseikonia.** Arch. of Ophth., 1938, v. 20, Dec., pp. 907-912; also Trans. Amer. Ophth. Soc., 1938, v. 36.

This term was coined by the author for a difference in size of the optical images of the two eyes. He discusses the consequences and symptoms arising from decompensation, and points out that the amplitude of adjustment in compensation for aniseikonia is limited as compared with the amplitude of accommodation or the amplitude of fusion. The chief causes of aniseikonia are anisometropia, the wearing of glasses of different magnifying power for the two eyes, and asymmetric convergence. When the eyes are unable to compensate for the aniseikonia suppression usually results. The three chief objections or criticisms to the claim that aniseikonia is an important factor in eyestrain are: first, that the benefit alleged to follow the use of eikonic lenses is really due to suggestion or psychotherapy, second, that eikonic lenses may have a considerable prismatic effect and may thus produce anisophoria, and third, that asymmetric convergence produces difference in size greater than many of the differences claimed clinically to cause symptoms but is compensated for by an automatic increase in the size of the optic image of the adducting eye.

J. Hewitt Judd.

Litinskii, G. A. **Monocular depth perception and the method of its determination.** Viestnik Opht., 1938, v. 12, pt. 4, p. 532.

The author attributes the general belief in the absence of monocular depth perception to the fact that all depth-perception apparatus is constructed for binocular tests. He describes an apparatus for measuring monocular tridimensional perception, which he designates as perception of solidity. He concludes that perception of solidity is a monocular as well as a binocular function. Its qualitative characteristics may be demonstrated on his apparatus. The physiologic threshold of solidity perception is 1 mm. for the better eye. In 72.5 per cent of cases monocular perception of solidity is equal to binocular perception, in the rest of the cases it is somewhat lower. The right eye is superior to the left eye in this function. Influence of sex and age is not apparent. R. K. Daily.

Ludvigh, Elek. **Determination and significance of the scotopic retinal visibility curve.** Arch. of Ophth., 1938, v. 20, Nov., pp. 713-725.

By utilizing experimental determinations of the selective absorption of light by the refractive media of the human eye, a scotopic ocular visibility curve, expressed in terms of energies, is transformed into a scotopic retinal visibility curve, expressed in terms of quanta by application of the Stark-Einstein law of photochemical equivalence. This curve is asymmetric and agrees with that representing the modern determination of the absorption spectrum of visual purple. The author briefly discusses the significance of the scotopic retinal visibility curve with respect to Kundt's rule, the Purkinje phenomenon, the purity of visual purple solutions, the b wave of the electroretinogram, and certain visual theories.

J. Hewitt Judd.

Maisler, S. **A new refractor suspension.** Arch. of Ophth., 1938, v. 20, Oct., pp. 1044-1045. To an adjustable table

is attached a standard supporting a chin rest and a large loop of tubing from the top of which is suspended the refractor. The instrument is shown in a photograph. J. Hewitt Judd.

Mann, Ida. **Applied optics.** Trans. Ophth. Soc. United Kingdom, 1938, v. 58, pt. 1, p. 109.

An excellent historical survey of the development of the contact lens in the one hundred years since Thomas Young presented the theory in Philosophical Transactions for 1801 is given. The subject is presented under three aspects, namely, the optical principles involved, the causes of intolerance, and the therapeutic indications.

Beulah Cushman.

Martin, L. C. **A standardized lantern for testing color vision.** Brit. Jour. Ophth., 1939, v. 23, Jan., pp. 1-19.

In an article not lending itself to abstract, the author discusses production and standardization of a lantern for use by the Board of Trade, with the Medical Research Council advocating employment of a similar lantern for the Royal Navy. The experiments which led to the standardization are fully discussed. (Figures, tables.) D. F. Harbridge.

Obrig, T. E. **A cobalt-blue filter for observation of the fit of contact lenses.** Arch. of Ophth., 1938, v. 20, Oct., pp. 657-658.

For observing the accuracy of the fit of a contact glass, a buffer solution containing one drop of fluorescein is used and is viewed with a dense cobalt-blue filter placed between the source of illumination and the eye. This produces a brilliant yellow-green glow wherever the contact glass is not in contact with the cornea or conjunctiva and a dark area where the lens touches the cornea and conjunctiva. J. Hewitt Judd.

Ogle, K. N. **Induced size effect: 1. A new phenomenon in binocular space perception associated with the relative sizes of the images of the two eyes.** Arch. of Ophth., 1938, v. 20, Oct., pp. 604-623.

The literature is briefly reviewed and the apparatus used for quantitative study of geometric and induced size effects is described. The data obtained are tabulated and are shown graphically. In addition to the change in apparent rotational position of the surface seen binocularly when a change is introduced in relative sizes of the ocular images in the horizontal meridian, a new and unexpected phenomenon of apparent rotation of the binocular visual field caused by a difference in the size of the image in the vertical meridian was found. Its exact cause is not clear. However, three facts have been determined. First, a one-to-one ratio of the maximum sensitivities of the induced to the geometric effect exists, though the two effects are opposite in sign; second, the effect reaches a maximum value for differences in size of the images in the vertical meridian greater than 5 or 6 percent; third, above this difference the induced effect decreases slowly. J. Hewitt Judd.

Ohm, J. **What is darkness? Remarks on the essay of Jac. v. Essen, etc.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 811-816.

Ohm cannot agree with Essen's psychologic description of darkness as a lack of optical differentiation in space (see Amer. Jour. Ophth., 1939, v. 22, p. 206). To Ohm, darkness means objectively the absence of light, or of ether waves of certain wave-length, and blindness means not a blurring but an inability to perceive light. The study of

nystagmus teaches that in miners, and in young children who grow up in badly lighted dwellings, nystagmus results from insufficient lighting. Darkness is a positive experience to many blind persons, just as black and darkness are employed in common speech and poetry as something positive.

H. D. Lamb.

Seidel, E. **The physiology of the process of accommodation in the human eye.** Graefe's Arch., 1938, v. 139, pt. 3, pp. 513-519.

Observations in a series of otherwise sound young albinotic human eyes were made with the eye focused for distant and for near vision while the direction of gaze remained unchanged. Examination with the ophthalmoscope disclosed that when the eye was accommodating to fix on a point at 10 cm. distance, the lens equator gradually contracted toward the lens axis, so that the equatorial diameter was diminished about 1 mm. If 1-percent atropine had been instilled one hour previously, this contraction of the lens equator did not occur. H. D. Lamb.

Semeikin, B. E. **Structural defects of Nagel's adaptometer.** Viestnik Opht., 1938, v. 12, pt. 4, p. 520.

A criticism of the adaptometer as manufactured in Russia.

Ray K. Daily.

Sudranski, H. F. **An evaluation of homatropine-benzedrine cycloplegia.** Arch. of Ophth., 1938, v. 20, Oct., pp. 585-596.

The refraction was determined for three groups of 25 patients, each group having similar age limits, to compare the cycloplegia obtained by homatropine hydrobromide plus cocaine hydrochloride, by homatropine and benzedrine, and by homatropine in one eye and homatropine-benzedrine in the other. Fifteen patients were studied to determine the exact cycloplegic effect of a 5-percent solution of homatropine and a 1-percent solution of benzedrine, used separately. The author concludes that a 5-percent solution of homatropine hydrobromide combined with a 1-percent solution of benzedrine sulphate may be recommended for production of cycloplegia, because the homatropine alone causes complete cycloplegia, the synergistic action between the two drugs produces good mydriasis, and the cycloplegia is of very short duration due to the small amount of homatropine used. J. Hewitt Judd.

Tron, E. Z. **Refraction of the aphakic eye.** Viestnik Opht., 1938, v. 13, pt. 4, p. 445.

From study of aphakic eyes the original refraction of which was known, and from the calculated aphakic refraction of eyes which had been examined with Tscherning's ophthalmophakometer, the author concludes that the same original refraction may lead to various aphakic refractions, and that the same aphakic refraction may be found in originally different eyes. These variations are accounted for by different combinations of the anteroposterior axis of the eye, the refractive power of the cornea, and that of the lens. Variations in the refraction of the aphakic eye thus depend on the various optical combinations of the aphakic as well as the original eye. From the calculated coefficient of correlation between the refraction of the eye previous to and after extraction of the lens, it is evident that the refractive power of the lens is the most significant factor in variations in refraction. Ray K. Daily.

Vianna, A. M. **A family of daltonians.** Ann. d'Ocul., 1938, v. 175, Dec., pp. 901-910.

The genealogical table of a color-blind family is given together with a brief discussion of tests for color-blindness and mendelian probabilities.

John M. McLean.

Weskamp, Carlos. **Uniocular diplopia.** Arch. de Oft. de Buenos Aires, 1939, v. 13, June, p. 279.

A review of the literature on the theories of uniocular diplopia other than the type due to aberrations of the refractive media, polycoria, and dislocation of the lens. Edward P. Burch.

4

OCULAR MOVEMENTS

Apple, Carl. **Congenital abducens paralysis.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 169-173.

Bielschowsky, A. **Lectures on motor anomalies. 6. Principles of surgical treatment.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 145-153.

Chavasse, F. B. **Primitive sight and human squint.** Liverpool Med.-Chir. Jour., 1938, v. 46, pt. 1, p. 19.

The author takes exception to the statement that "binocular vision is a late acquisition in phylogeny." He states that in man the developmental period of binocular vision is more prolonged. Not until the age of three years is it ordinarily complete.

There is perversion of reflexes which become perfected and fixed at an early age, making it obligatory not to regard too lightly a lapse of binocularity in an infant. F. M. Crage.

Duguet. **Parinaud's congenital syndrome.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 424.

Case report showing vertical paralysis, complete lack of convergence, corectopia, miosis, and ptosis. It is ascribed to a lesion in the hypothalamic region. Five previous cases have been reported. (5 references.) Harmon Brunner.

Howard, W. H. **Monocular protection versus monocular occlusion.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 156-160.

Jameson, P. C. **Technique of scleral fixation of extraocular muscles.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 25-29.

The subject of scleral fixation is thoroughly reviewed, including the technique of scleral suturing in the region of the equator, instrumentation, the choice of needle, and the advantages of catgut. (3 figures, 6 references.)

Ralph W. Danielson.

Majewski, Kasimierz. **Presbyopia and exophoria.** Klinika Oczna, 1938, v. 16, pt. 5, p. 535.

The writer calls attention to the exophoria which accompanies presbyopia, and which he attributes to relaxation of convergence caused by weakening of accommodation. Ray K. Daily.

Peter, L. C. **Present status of tendon transplantation of the ocular muscles.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 30-38.

An excellent discussion of the technique used in the various situations where tendon transplants are indicated. (4 figures, 4 references.)

Ralph W. Danielson.

White, J. W. **Surgical technique in tenotomy of the inferior oblique muscle.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 83-88.

This article is difficult to abstract

but should be read by anyone interested in the operation. (3 references.)

Ralph W. Danielson.

Ziering, Josef. **The function of the squinting eye and the squint deviation.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 759-789.

In examination of 112 patients with squint, the findings included the following information: (1) monocular function of the squinting eye, its ability to fix, visual acuity without and with correction, its visual field with the perimeter and scotometer; (2) whether and in what respect the squinting eye works with the fellow-eye; (3) the kind, amount, and character of the squint deviation. All the author's cases with high-grade amblyopia, where the visual fields could be determined, presented either a central (usually relative) or a paracentral scotoma. Amblyopia is caused by anisometropia, when no fusion exists, and the eye with less refractive error and the better image is used, the other eye ignored. When both eyes have about the same change of refraction, alternating squint prevails in the absence of fusion.

H. D. Lamb.

5

CONJUNCTIVA

Cornet, Emmanuel. **Concerning some symptoms of trachoma described by Keller in 1937.** Rev. Internat. du Trachome, 1938, v. 15, Oct., p. 165.

The author reviews several publications of Keller and discusses some of the points brought out. The disease is a familial one but primary infection may occur in the adult. The interstitial keratitis of syphilis is easily distinguished from the pannus of trachoma. Corneal sensitivity in trachomatous patients shows great variability, certain zones being more insensitive than others. The author distinguishes three varieties of trachoma: (1) pure trachoma, (2) paratrachoma or that secondarily infected, (3) that associated with other palpebro-conjunctivo-corneal diseases. J. Wesley McKinney.

De Lord. **Treatment of trachomatous pannus by subconjunctival autohemotherapy.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 372.

Report of six cases treated with 1-c.c. subconjunctival injections of whole blood; at the same time using mercuric-chloride rubs on the superior tarsal conjunctiva. There was immediate improvement in the pannus.

Harmon Brunner.

Grüter, Wilhelm. **Microstructure of epithelial cells and its significance for the etiology of trachoma.** Rev. Internat. du Trachome, 1938, 15th yr., Jan., pp. 9-14. (In German.) (See Amer. Jour. Ophth., 1938, v. 21, Aug., p. 946.)

Jaeger, Ernst. **Operative method for pterygium.** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 741.

The method is described in detail. Its advantages are: (1) Healthy conjunctiva lies opposite the disturbed corneal area, and this prevents a relapse. (2) The scar which closes the conjunctiva lies in healthy tissue above the diseased area, so that soft smooth cicatrization is possible. C. Zimmermann.

Kapuscinski, Witold, **Bacteriology of trachoma.** Klinika Oczna, 1938, v. 16, pt. 5, p. 664.

A lecture on trachoma for practicing physicians, covering thoroughly the published material on the subject.

Ray K. Daily.

Katznelson, A. B., and Pris, I. I. **Phlyctenular eye diseases and tuberculosis.** Viestnik Opht., 1938, v. 12, pt. 4, p. 447.

On the basis of 270 cases of phlyctenular keratoconjunctivitis the author comes to the following conclusions: a tuberculous etiology may be considered established on the basis of clinical and roentgenologic findings as well as of tuberculin reactions. The majority of cases of phlyctenular conjunctivitis occur between one and eleven years of age, and females are affected more frequently than males. The majority of patients have clinical and roentgenologic changes, active in character, in two thirds of the cases. In all cases, even in the absence of clinical signs there is a high sensitivity to tuberculin, although there is no parallelism between the intensity of the disease and of the tuberculin reaction. The younger the patient, the greater the percentage of clinical symptoms. Among the active forms of tuberculosis the infiltration type predominates. The presence of cavernous changes makes the prognosis of the ocular infection more grave. Active clinical tuberculosis is most frequently found in cases of avascular keratitis, less frequently in pannus, and in 50 percent of phlyctenular conjunctivitis. Phlyctenules of the limbus and avascular keratitis are early manifestations of tuberculosis. Pannus develops after recurrent attacks and is therefore seen in older people. Exacerbations of pannus keratitis are less dependent on the toxicity of the tuberculous focus than are other forms of phlyctenulosis. Phlyctenular keratoconjunctivitis is frequently the only symptom of active tuberculosis and should lead to early diagnosis of the disease.

Ray K. Daily.

Kirk, R., McKelvie, A. R., and Hussein, H. A. **Sulphanilamide in the treatment of trachoma.** The Lancet, 1938, v. 235, Oct. 29, p. 994.

Twenty-five cases of trachoma were treated by sulphanilamide by mouth, 7½ grains three times a day for seven days, with seven-day intervals between courses. Encouraging results were reported, especially in cases showing pannus and keratitis. George A. Filmer.

Lijo Pavia, J. **Prevention of blindness. Silver acetate or nitrate in the prevention of ophthalmia neonatorum.** Rev. Oto-Neuro. Oft., 1938, v. 13, July, p. 171.

The author feels that silver acetate is a safer drug to use than silver nitrate in Credé treatment of the new-born. The acetate is less soluble and therefore cannot be used in high concentrations. This obviates the possibility of corneal damage if too high concentrations are used by mistake. He believes the acetate is as effective as the nitrate.

Edward P. Burch.

Lijo Pavia, J., Irigoyen, L., and Tartari, R. A. **Conjunctival xerosis. Anatomico-pathologic contribution.** Rev. Oto-Neuro. Oft., 1938, v. 13, Aug., p. 189.

The authors report two cases of xerosis of the conjunctiva which were observed clinically. A biopsy was made in one case and the tissue subjected to microscopic study. Essentially the lesion consisted of a regressive metaplasia of the conjunctival epithelium to the cutaneous type, with keratinization of the superficial layers, vacuolization and hyalinization of the malpighian layer, and invasion by melanophores and melanoblasts. The authors point out that the conjunctival lesions con-

stitute but one aspect of ophthalmic xerosis and that the visceral lesions which result from avitaminosis with respect to vitamin A may be of a very grave nature. (Photomicrographs.)

Edward P. Burch.

Madroskiewicz, M., and Przybylkiewicz, Z. **Tuberculosis of the conjunctiva and so-called Parinaud's conjunctivitis.** Klinika Oczna, 1938, v. 16, pt. 5, p. 561.

A review of the literature and a report of a case of tuberculosis of the conjunctiva caused by the bovine tubercle bacillus. The bacilli were found in conjunctival granulations, and in the secretion from a necrosed preauricular lymph gland. The diagnosis was confirmed by inoculation into a guinea pig. X-ray therapy and cauterization with lactic acid were ineffective, and the granulations were removed surgically. Recovery followed without recurrence in the eyes, but with recurrence in a preauricular lymph gland. (Illustrations.) Ray K. Daily.

Magitot and Rossano. **Propagation or superinduced infection in a case of bilateral tuberculous conjunctivitis.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 383.

A six-year-old girl with a tuberculous ulcer in the pharynx subsequently developed bilateral dacryocystitis and conjunctivitis. One eye had a conjunctival ulcer, the other follicles. The etiology is considered more likely one of extension than of superinduced infection, although the child lived in a tuberculous family.

Harmon Brunner.

Meyer, F. W. **Essential shrinking of the conjunctiva or pemphigus?** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 708.

Two cases of pemphigus foliaceus of the conjunctiva are described, occurring in a man of 84 and one of 28 years. Histologic description is given in detail. The two conditions are regarded as closely related. (See editorial this issue, p. 439.) C. Zimmermann.

Onfray, D. B. **A case of vernal conjunctivitis treated with radium.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 367.

The patient had had one eye treated with radium thirteen years earlier. He presented keratinization of the skin, notching of the lid, blanching of cilia, leukoplakia of the tarsal conjunctiva with sclerosis, pannus-like growth over the cornea, and anterior cortical cataract. The untreated eye was healthy and free from signs of vernal catarrh. The authors feel that radium therapy is unwarranted in these cases. (3 references.) Harmon Brunner.

Thygeson, Phillips. **Sulphanilamide therapy of inclusion conjunctivitis.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 179-180.

6

CORNEA AND SCLERA

Amsler, Marc. **Minimal keratoconus of Javal.** Ophthalmologica (formerly Zeit. f. Augenh.), 1938, v. 96, Nov., p. 77.

The author describes and illustrates a characteristic of minimal and incipient keratoconus by which it may be unequivocally recognized. It is an asymmetry of its surface reflections, readily demonstrated by means of the Placido disc or the mires of an ophthalmometer. The image of the horizontal axis of the Placido disc is not at right angles to that of the vertical axis, but deflected

several degrees. Such an angle also exists between the right and left images of the mires of the ophthalmometer.

F. Herbert Haessler.

Amsler, M. **Note on the evolution of keratoconus.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 326-333.

Using as pathognomonic sign a depression of the horizontal axis of the keratoscopic image, obtained photographically, the writer reports his conclusions after study of 131 subjects, 105 of whom have been followed for over ten years. The malady makes its appearance in the years following puberty, has little tendency to progress, has never been observed to lessen or improve, is characterized often by crises of pain, redness, and severe irregular astigmatism. The crises disappear without seemingly being a part of any evolutionary changes in the malady.

Clarence W. Rainey.

Bonnet, P., and Gate. **Interstitial keratitis observed in the secondary phase of acquired syphilis.** Bull. Soc., d'Opht. de Paris, 1937, July, p. 417.

Interstitial keratitis developed in a 27-year-old female seven days after institution of arsenical therapy. About twenty Wassermanns had been negative in the two years before the positive reaction, after which treatment was given. There was the characteristic clouding of the corneal parenchyma, with deep vascularization.

Harmon Brunner.

Cornet, Emmanuel. **Conjunctivoplasty of the cornea, quantitative vision.** Ann. d'Ocul., 1938, v. 175, Dec., pp. 914-916.

In cases unfavorable for keratoplasty, a central corneal leukoma may be excised and the defect covered by a sliding tongue of conjunctiva. As this flap heals over the hole, its translucency gives a completely blind eye "minimal vision." John M. McLean.

Cornet, Emmanuel. **A technique of corneal graft "in stenopeic slit."** Ann. d'Ocul., 1938, v. 175, Dec., pp. 910-914.

After a brief review of methods of keratoplasty, the author presents his method of grafting a horizontal rectangle. A conjunctival flap just wide enough to cover the graft and long enough to stretch across the cornea is prepared so that hinged at the limbus it will cover the graft, epithelial side down. The conjunctival defect is closed. The donor eye (apparently rabbit rather than human) is enucleated, washed in serum, and its entire cornea removed. This is placed in a special graduated clamp and a strip 3 mm. wide and 6 mm. long marked out on it. Intracorneal sutures are placed 1 mm. from each end and the graft excised. An area of the same size is marked on the recipient cornea, long axis horizontal, with a metal template, and is excised. Any presenting iris tissue is cut off. Cataractous lens, if present, is then extracted through this opening, extracapsularly. Any existing cyclitic membrane is incised. The intracorneal graft sutures are then passed through the edges of the defect in the cornea at the appropriate points and the graft drawn into place with them. The inverted conjunctival flap is fastened in place under tension and the corneal sutures tied over it. The corneal sutures are removed by the third day and the flap by the tenth.

No cases are described, nor are any results reported. John M. McLean.

Culler, A. M. **The pathology of**

scleral plaques. Brit. Jour. Ophth., 1939, v. 23, Jan., pp. 44-50.

Described are five cases of degenerative plaques in the sclera mesially, one studied histologically. Each case is described in detail. The plaques occur chiefly in patients over sixty years of age. The opinion of the author is that no clinical symptoms arise from the lesions, and that the histological appearance is that of a degenerative rather than of a developmental defect. (Figures, bibliography.)

D. F. Harbridge.

Dejean and Artières. **Experimental study of the healing action of insulin on corneal wounds.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 303-307.

Using three-month-old rabbits, the authors removed a superficial portion of the cornea with a 20-mm. trephine, and noted the time necessary for regeneration of the loss of substance, by observing the staining of the cornea with methylene blue. They conclude that a daily injection of 10 to 15 units of insulin shortens the healing period from two to four days. Insulin in ointment form did not have any effect.

Clarence W. Rainey.

Ellis, O. H. **Superficial marginal keratitis. Clinical and anatomic findings in fellow eyes.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 161-168.

Kapuscinski, W. **The influence of radium on interstitial keratitis.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 308-317.

The optimum dose was found to be 66 mg. of radium element, placed in a platinum filter 1 mm. thick, held at a distance of 2 cm. from the eye for six hours. The majority of the patients had the disease six months or less. The final vision of twenty-two percent was 5/5. The best results were obtained in the earliest cases. Improvement was noted in a few weeks, and took place more rapidly and to a greater extent than in untreated cases. The author did not observe the formation of cataract in any of the cases treated.

Clarence W. Rainey.

Motolese, A. **Hypopyon keratitis and hypertony.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 382-399.

The author studied the effect of induced hypertension upon the course of infected ulcers of the rabbit cornea produced by inoculating the cornea with streptococci, pneumococci, and staphylococci. He concludes that hypertension exerts an unfavorable influence upon the course of the disease.

Clarence W. Rainey.

Pandelesco, C., and Valdman, J. **Rosacea keratitis.** Arch. d'Opht., etc., 1938, v. 2, Dec., p. 1080.

The authors review the literature and history of rosacea keratitis, and describe three typical cases. They point out the polymorphism of the lesion, varying from true ulcers to simple zones of infiltration and leucomata of fibrous tissue. The blood vessels vary in size according to the stage of the lesion, being largest in the ulcerous stage. The limiting furrow of the necrotic lesion is deeper in one part than another. The cicatricial opacities lie over an area of cornea which is thinned. The authors treated the cases with success, using 1-percent silver nitrate, zinc-ichthyol ointment, milk diet followed by a milk and vegetable diet, and occasional dry heat from the galvanocautery. (Bibliography.)

Derrick Vail.

Rhodes, A. J., **Studies on the bacteriology of hypopyon ulcer.** Brit. Jour. Ophth., 1939, v. 23, Jan., pp. 25-42.

This paper is the first in a series of studies carried out by the W. H. Ross Foundation for the Study of Prevention of Blindness.

Under part 1, concerning the conjunctival flora of healthy coal-mine workers, the author deals with preparation of cultures, classes of workers examined, mines visited, controls, and results. It was found impossible, because of varying conditions of dust, moisture, ventilation, and so on in the various pits, to compare one mine worker with another. The percentage of various organisms in the whole pit is noted in some instances, while the percentage present in the total of 658 men examined is recorded in others. Staphylococcus albus and diphtheroid bacilli were present in quantity, while pigmented staphylococci were not so commonly found. Underground workers did not demonstrate a flora essentially different from that of surface workers. Those most apt to contract the disease are those most exposed to corneal trauma, or the miners and brushers. Under part 2, as to the conjunctival flora of shale-mine workers, the same procedures are reviewed, with the finding that shale-mine workers nurture a flora composed in part at least of potential pathogens. The opinion is maintained, as based on both types of mine workers examined, that the source of infection in hypopyon ulcer is from organisms already present in the conjunctival sac and that the conjunctival flora definitely exposes the mine worker to infection. (Tables, references.) D. F. Harbridge.

Rubbrecht, R. **The surgical treatment of corneal conditions.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 318-325.

The author discusses a method of transplanting a thin layer of neighboring conjunctiva, which is generally applicable to a large number of corneal maladies, especially those of the epithelium and the superficial layers. The affected tissue is excised with a special lancet, and the loss of tissue covered with bulbar conjunctiva. The corneal transparency is greater than from the scar of the original process.

Clarence W. Rainey.

Terry, T. L. **Some physiological and anatomical aspects of the cornea affecting its pathology.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 153-155.

Thomas, J. W. T. **Corneal transplantation.** Brit. Med. Jour., 1938, Oct. 8, p. 740.

Results of 56 operations on 48 eyes are given. The technique was the same as used by the author in his previous cases, except for two modifications; namely, using saline instead of oil for receiving the graft, and so arranging the cross stitches that the knots do not lie on the graft or its edges.

Over 60 percent of the operations and 66 percent of the eyes operated on were successes. Five of the nine cases of old interstitial keratitis exhibited clinically transparent grafts. Out of thirty cases observed for a period of years, six showed deterioration and one actually improved. With the modified technique now used, it is anticipated that the deterioration of 20 percent of the grafts over a period of years will be considerably reduced. F. M. Crage.

Wille, W. A. **Keratitis ramificata superficialis and its connection with**

asthenopia, blepharospasmus nictitans, and pterygium. Brit. Jour. Ophth., 1938, v. 22, Dec., pp. 705-722.

The author believes that this disease has not been discussed in ophthalmic literature although he himself described it in 1914 in a medical periodical in the Dutch East Indies. The disease confines itself to the epithelium. A thin layer of lacrimal fluid which always covers the cornea must be evaporated before the condition is manifest. The specific relationship between this eye disease and pyterygium is pointed out and described. The disease is rather common in the tropics, the author having treated many cases in Java, a number of which are described. He regards the disease as due to climatic conditions such as heat, glare, wind, and dust. Some living agent seems to be indicated by the racemose way in which the disease advances. (Case histories, figures, tables.)

D. F. Harbridge.

Zobel, Hans. **Sensitivity of the cornea in different periods of life.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 668-676.

For this study, the normal corneae of 261 females and 270 males, together with 54 pathologic cases, were examined as to sensitivity. In the normal cornea, this was found to gradually increase in degree with age, until it attained a maximum between 45 and 50 years. Thereafter, it diminished more rapidly with age to reach a minimum between 80 and 90 years. These changes of sensitiveness are more definite peripherally than centrally in the cornea. The author was able to confirm the fact that the sensibility of the cornea diminished from its center toward the limbus.

H. D. Lamb.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Alexseev, V. I. **Pigment allergy in sympathetic ophthalmia. The significance of the intradermal test.** Viestnik Opht., 1938, v. 12, pt. 4, p. 468.

A review of the literature and a tabulated report of intradermal tests of 26 patients with uveitis pigment, prepared by the author. In six cases the cutaneous reaction areas were excised and examined histologically. The intradermal tests were positive in five cases of sympathetic ophthalmia, in two with traumatic iridocyclitis, and in one of recurrent iritis. The reaction was negative in one case of sympathetic ophthalmia and in seventeen cases of traumatism. Pathologically, the excised cutaneous segments had extensive proliferation of cells belonging to the reticulo-endothelial tissues. Of the six cases examined, in five the gross findings agreed with the microscopic. In one case the skin test was clinically negative but microscopically positive.

Ray K. Daily.

Lagrange, H., and Goulesque, J. **Iritis and focal infection.** Bull. Soc. Franç. d'Opht., 1938, v. 51, p. 334.

This article is practically an abbreviated paraphrase of a previous article on the same subject (see Amer. Jour. Ophth., 1938, v. 21, p. 1292).

Okolow-Hrynkiewiczowa, Z. **Sympathetic ophthalmia. A report of three cases of sympathetic ophthalmia with favorable result.** Klinika Oczna, 1938, v. 16, pt. 5, p. 539.

The local treatment consisted of homatropine, atropine, dionin, and hot fomentations. General treatment consisted in the intravenous administra-

tion of arthrosan (sodium phenylcinchonate and sodium salicylate) autohemotherapy, intravenous injections of urotropin, and increasing doses of an antituberculous antigen. The author stresses the fact that sympathetic ophthalmia is not an incurable disease but that treatment must be instituted before irreparable damage has been done. For early diagnosis examination with the slitlamp is indispensable.

Ray K. Daily.

Saburov, G. I. **A case of neurofibroma of the upper lid and nodules in the iris in Recklinghausen's disease.** Viestnik Opht., 1938, v. 12, pt. 4, p. 557. (See Section 14, Eyelids and lacrimal apparatus.)

8

GLAUCOMA AND OCULAR TENSION

Csillag, Franz. **Essential atrophy of the iris and glaucoma.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 874.

Two cases are reported, in which the atrophy arose from the tension and from disturbance of the blood supply of the iris. The glaucoma complicating the iris atrophy was secondary. The tension was lowered by pilocarpine, and even reached normal.

C. Zimmermann.

Greenwood, Allen. **Surgery of secondary glaucoma.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 10-13.

In sarcoma of the choroid and in cases of complete obstruction of the central vein of the retina followed by hypertension, enucleation is the only adequate surgical measure. Tuberculin in minimal doses instead of surgery is recommended in tuberculous uveitis. After cataract extraction and contusion and in cases of iritis, medication will usually hold the tension, but a simple iridectomy may be needed.

Ralph W. Danielson.

Kaminskaja, Z. A., and Gubina, H. M. **The diagnostic significance of the Seidel test.** Viestnik Opht., 1938, v. 12, pt. 4, p. 479.

The authors' observations demonstrate that Seidel's reaction is reliable only in cases of glaucoma with an active iris sphincter. In absolute glaucoma with iridoplegia the reaction was negative. No relation could be demonstrated between this reaction and dispersion of the iris pigment. The author believes that the increased tension is due to liberation of chemical substances into the aqueous by dilatation of the pupil.

Ray K. Daily.

Kayser, B. **May central scotoma with intact peripheral borders or concentric narrowing of the visual field be compatible with a diagnosis of glaucoma?** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 883.

The author has reported (see Amer. Jour. Ophth., 1934, v. 17, p. 273) an extreme case of this kind in a woman in whom observation from her fiftieth to her seventy-fifth year had negatived a diagnosis of glaucoma. He examined the patient again in her eightieth year. The right disc showed the same excavation of 6 or 7 D., the left from 3 to 4 D. (of glaucomatous character). Vision was 1. The tension was 28 mm. In spite of the development by 1926 of a central scotoma and marked concentric contraction of the visual field as well as the later developments as to tension and excavation of discs, the diagnosis of glaucoma is still rejected.

C. Zimmermann.

Noble, R. L., and Robertson, J. D. **The effect of hypertonic solutions on**

gastric secretion and intraocular pressure. Jour. of Physiology, 1938, v. 93, Sept. 16, p. 430.

In animals where gastric secretion and intraocular pressure have been measured, it has been found that following intravenous injections of 30-percent NaCl 5 c.c. per kg. at the rate of 2 c.c. per minute there was a striking fall in the pressure of the eye and in volume and acidity of gastric juice. Fifty percent glucose had to be given in more than three times the amount and rapidity of the 30-percent NaCl to obtain similar results.

These solutions caused a dilution in hemoglobin which rapidly returned to normal. Intraocular pressure was markedly lowered and remained so for some hours. This was quite independent of the variations in blood pressure. The findings indicate that dialysis is not a satisfactory explanation of the formation of the aqueous humor. A similarity in response to hypertonic solution between gastric secretion and intraocular pressure suggests that a secretory process may play some part in controlling intraocular pressure. F. M. Crage.

Tatár, Josef. **Glaucoma in Cushing's disease.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 793-800.

In a 24-year-old farmer's wife with Cushing's disease, there occurred a periodic increase of tension of both eyes with pronounced constriction of the visual fields. This increase of tension was considered to be due to a senilitas praecox as well as to hyperfunction of the adrenal cortex. The considerable contraction of the fields was partly the result of the increased tension but was possibly associated with spastic changes in the retinal arteries.

H. D. Lamb.

9

CRYSTALLINE LENS

Bakker, A. **The importance of the iris in the production of infrared cataract.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 667-703.

Rabbit lenses, transplanted to a constant-current tissue-culture, were exposed to rays of an electric incandescent bulb and to those of an arc light. In the genesis of heat cataract, not only the penetrating infrared but also the long-wave infrared rays are important. In both series of experiments the iris played a definitely important part in the production of cataract. A notable specific absorption of the penetrating infrared rays could not be demonstrated for the lens. Infrared rays, after having passed through the entire thickness of a lens without causing the least injury, caused extensive opacities in a second lens covered by its iris. Cataract in the posterior cortex was produced purely by the action of the iris, when all direct rays were excluded. The typical posterior cortical cataract of glass-blowers cannot be the result of direct action of the rays. The so-called specific ultrared cataract of Vogt's experiments is nothing but an ordinary heat cataract.

H. D. Lamb.

Bangerter, A. **An unusual case of diabetic cataract.** Ophthalmologica (formerly Zeit. f. Augenh.) 1938, v. 96, Nov., p. 98.

In a child of eleven years, the entire lens of each eye was occupied by fine punctate opacities such as are usually found in the cortex. The planes of optical discontinuity were not visible. This observation does not support the generally held belief that exogenic noxa can only produce superficial lenticular

changes before disintegration of the lens takes place.

F. Herbert Haessler.

Berens, C., and Bogart, D. W. **Certain postoperative complications of cataract operations.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 39-61.

Analysis of the results of 1,004 operations and review of the literature. Thirty percent were intracapsular. Preoperative examination and precautions are stressed. (12 figures, 13 tables, 104 references.) Ralph W. Danielson.

Corboy, P. M. **A corneoscleral union for cataract operations.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 174-175.

Podesta, H. H., and Bancke, J. **The source of vitamin C in the different tissues of the eye.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 720-731.

Investigation showed that in cattle, horses, and sheep the concentration of vitamin C was increased from the ciliary body and iris through the aqueous humor to the lens. These conditions for vitamin C were found reversed in rabbits, dogs, and guinea pigs. As regards the synthesis of vitamin C, rabbit lenses showed no demonstrable ability, cattle lenses had a strong action, and in guinea-pig lenses it varied according to the extent of the fall of vitamin C from lens to ciliary body and iris, from none to a moderately strong synthetic capacity. H. D. Lamb.

Reiser, K. A. **Our experiences with intracapsular cataract extraction.** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 692.

At the Bonn eye clinic intracapsular extraction has been used since 1932. The advantages and disadvantages of this method are discussed on the basis of 300 cases and the results compared with 100 extracapsular extractions. Intracapsular extraction is technically somewhat more difficult. Prolapse of vitreous is more frequent, as well as postoperative iris prolapse. The advantages are: Intracapsular extraction is a single procedure. The physiologic relations (round movable pupil, no adhesions of the pupillary margin) are better preserved. Speedy healing is had without irritation. The visual results are better. In all cases of cataract, except congenital, the intracapsular method was attempted, and it succeeded in 72.2 percent. It should be tried in every case from the minimum age of 40 years, in incipient senile, nuclear, posterior cortical, complicated, and contusion cataract. A contraindication exists in all congenital and acquired cataracts up to the fortieth year of age. C. Zimmermann.

Riad, M. **Congenital familial cataract with cholesterin deposits.** Brit. Jour. Ophth., 1938, v. 22, Dec., pp. 745-749.

After citations from the literature relative to this hereditary condition, cases are reported. Discussion is based on the history of two half sisters. In the thirteen cases examined, there was no history of consanguinity, nor of mental disturbance or convulsions. Hereditary influence was strongly marked in the females, with continuous descent followed through three generations from an affected female. No constitutional diseases were noted. The author bases his opinion that such cataracts are of congenital origin on the premise that the opacities are seen in the central embryonic nucleus. This is further substantiated by the similarity of all cases and the presence of the condition in both eyes. The type of cataract is fully described. The per-

centage of cholesterol in the blood was diminished according to the findings here presented. (Figures, references.)

D. F. Harbridge.

Salit, P. W. **The mineral content of cataractous and sclerosed human lenses.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 654-667.

Altogether 115 cataractous and sclerosed human lenses were analyzed as to the content of potassium, sodium, calcium, chlorine, phosphorus, and sulphur in their ash. The average weight of ash in incipient cataract amounts to 0.921 percent, that in mature cataract 1.067 percent of the moist weight. When one compares this amount with the dry weight and water content, it is found to represent 2.836 percent and 1.392 percent for incipient and 4.010 percent and 1.427 percent for mature cataract respectively. The average content of ash in mature cataract therefore exceeds that of incipient cataract by 16.0 percent, 41.0 percent and 2.5 percent on the basis of the moist weight, the dry weight, and the water content, respectively. The much greater difference in percentage estimated in comparison with the dry weight arises from the small amount of solid substance in mature cataract as compared with that of incipient cataract.

When one compares the total sum of electrolytes by percentage of the dry weight, this increases with advancing stages of cataract and of sclerosis, as a result of the diminution of solid substances in cataractous as well as in sclerosed lenses.

H. D. Lamb.

Tron, E. Z. **Refraction of the aphakic eye.** Viestnik Opht., 1938, v. 13, pt. 4, p. 445. (See Section 3, Physiologic optics, refraction, and color vision.)

Urbanek, J. **The C-vitamin metabolism of cataract patients.** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 670.

In a former article (see Amer. Jour. Ophth., 1938, v. 21, p. 1416), the author showed that in most cases of postoperative hemorrhages in cataract patients a lack of vitamin C could be held responsible. By saturation experiments with vitamin C and by regular administration of vitamin C in cataract patients, postoperative hemorrhage into the anterior chamber was entirely prevented. The author now reports on further tests. Saturation was judged from the quantity of excretion in the urine. The observations are given in tabular form with the following results: (1) The juvenile organism is better provided than the senile with vitamin C. (2) Development of cataract in old people does not always run parallel with a notable C-avitaminosis. There are well nourished cataract patients whose vitamin C condition equals that of the youthful organism. (3) From the fact that the senile organism is poorer in vitamin C one must not conclude that development of cataract is a consequence of C-avitaminosis. (4) The constancy of ascorbic acid in the aqueous, independent of the saturation of the organism, indicates that increase and decrease of vitamin C probably occur more slowly than in the blood serum. (5) The lens is not necessary or responsible for the formation or accumulation of vitamin C in the aqueous. The author's attempts to arrest or clear up incipient opacities of the lens of the second eye in cataract patients showed no satisfactory results.

C. Zimmermann.

Vogt, Alfred. **First histologic finding of lens-capsule precipitates.** Klin. M. f. Augenh., 1938, v. 100, Nov., p. 703.

Three precipitates on the posterior surface of each cornea in a woman of 76 years, who had had lens-capsule glaucoma in the right eye (enucleated in 1932) are described and illustrated.
C. Zimmermann.

Vogt, Alfred. **Further as to clinical course and histology of senile desquamation of the anterior capsule.** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 705.

The lamellae projecting into the anterior chamber were observed with the slitlamp for years, and now after death of the patients have been examined anatomically. They show how oval vacuoles in the superficial layers of the capsule pave the way for destruction. The eyeballs were enucleated immediately after death.
C. Zimmermann.

10

RETINA AND VITREOUS

Damel, C. S. **Preretinal hemorrhage.** Arch. de Oft. de Buenos Aires, 1938, v. 13, June, p. 283.

This is a lengthy discourse upon the pathogenesis, evolution, and ophthalmoscopic appearance of preretinal hemorrhages. The historical aspect of the subject is reviewed. The author feels that preretinal hemorrhages may be explained on the basis of venous stasis, this being the case whether the basic cause of the hemorrhage is sclerosis of the retinal vessels, head injury, or periphlebitis. The article is profusely illustrated with fundus photographs and diagrams. Edward P. Burch.

Dubois-Poulsen. **The action of hypophyseal extract and adrenalin on the fringes of the pigment epithelium of the frog.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 377-380.

The action was found to be the same as that on the skin. Controls were run in sunlight and darkness. Hypophyseal extract caused retraction of the fringes of retinal pigment. Adrenalin caused extension. The author confirms the epidermal origin of the pigment. A similar action may occur in man, in whom adrenalin is known to accelerate dark adaptation. Harmon Brunner.

Grafova, Kornelia. **Detachment of the vitreous.** Klinika Oczna, 1938, v. 16, pt. 5, p. 576.

A tabulated report of the examination of 37 eyes, in 28 of which vitreous detachment was found. The author reviews the literature and concludes from her findings that vitreous detachment does not predispose to retinal detachment but on the contrary prevents it; and that detachment of the vitreous and of the retina are caused by the same pathologic process within the eye. (Illustrations.) Ray K. Daily.

Hofe, K. vom. **Changes in the fundus from diabetes.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 801-810.

The most characteristic finding in the fundus from diabetes is the dots of hemorrhage lying superficially and in the deeper layers of the retina. The white foci in the retina are white only when located superficially in the retina. When they lie in the deeper retinal layers, they are more dull and light gray, tinged with yellow or at times greenish. The white foci occur also in arterial hypertension and other diseases. In the majority of patients with diabetic retinal changes an increase of blood pressure exists. Usually, when retinal changes are present, the amount of blood sugar varies between 0.15 and 0.35. Acetone and aceto-acetic acid are frequently absent. An increase of fats

in the blood is generally found in the presence of retinal changes from diabetes. Nevertheless, the lipoid content of the blood is frequently increased when no retinal changes occur. In the majority of cases with diabetic changes in the fundus, the patients are not young and the diabetes has been present more than five years. From the metabolic disturbances in diabetes, there occur injuries to the vessels. The latter lead to nutritional disturbances of the retinal tissue. The white foci represent the reaction of the retina to its disturbed nutrition.

H. D. Lamb.

Kinukawa, C. **Two cases of eclamptic retinitis (gravidarum) with pathologico-anatomic findings.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 640-653.

As in albuminuric retinitis, so also in eclamptic retinitis, the inner retinal layers are always normal and entirely free of edematous loosening of the tissue. The changes in the choroidal vascular system, and of the retinal pigmented epithelium, cause the diffuse opacity in the fundus in eclamptic retinitis. The clinical appearance of a so-called glassy retinal edema in eclamptic retinitis is most probably dependent upon a focal collection of subretinal fluid accompanied by no damage to the overlying retina. A change of the retinal pigmented epithelium in eclamptic retinitis, not previously noted, is pronounced pyknosis and atrophy of the nucleus. This indicates here, as in the liver and kidney, rather the injurious action of toxic material than a simple disturbance of nutrition. H. D. Lamb.

Klemens, F. **The presence of cystoid degeneration in the periphery of the retina and its relation to the new-formed vascular layer.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 743-758.

The formation of hollow spaces in the periphery of the retina occurs at every age. This cystoid degeneration originates and develops independently of the new-formed vascular layer between the pigmented epithelium of the retina and the lamina vitrea, described by Löhlein. The cause of the formation of hollow spaces in the retinal periphery is still not satisfactorily explained.

H. D. Lamb.

Koyanagi, Y. **What does integrity of the retinal periphery in albuminuric retinitis indicate?** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 844.

The author opposes the theory of Volhard that albuminuric retinitis is due to angiospastic disturbance of nutribution. According to him, integrity of the periphery indicates chiefly a detrimental effect of toxic substances, as there are no known cases of nutritional disturbance of the retina with intact periphery. C. Zimmermann.

Pischel, D. K. **Late results in retinal-detachment operations.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 130-134.

Rumbaur, W. **Rare causes of detachment of the retina. (a) lues, (b) flaming nevus.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 866.

The right eye of a woman of 44 years, who denied venereal infection, showed diffuse chemosis caused by episcleritis. At the lower half of the fundus was a large vesicular detachment of the retina covering the disc and the macula. Repeated punctures of this by sclerotomy evacuated subretinal yellow fluid. The Wassermann reaction was positive. Antisyphilitic therapy restored vision to 3/60 with reattachment of the retina,

which was apparently due to transudation of serum from some syphilitic choroidal vessels. A connection with the episcleritis could not be determined with certainty.

An otherwise healthy, robust, nonmyopic man of 23 years, upon stooping after strenuous bodily exertion, developed detachment of the left retina, and the eye became blind. After twelve years a detachment of the right retina occurred after similar physical exertion. The patient had an extensive flaming nevus of the whole face, with elephantiasic, proboscis-like thickening of the upper lid and angiomatous vascular changes in the outer tunics of the eye, but not involving the interior. Very probably the cause of the retinal detachment was associated with the nevus flammeus as well as the unusual bodily exertion. C. Zimmermann.

Sakler, B. R. **Retinal detachment.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 175-179.

Sobhy Bey, M. **My experiences in retinal disinsertions.** Acta Ophth. Orientalia, 1938, v. 1, Oct., p. 1.

The author reviews the different methods employed for treating disinsertion of the retina at the ora serrata. He is in favor of diathermy but uses catholysis for larger disinsertions. He obtained a perfect cure in four instances out of the eight cases he reports. Disinsertions starting in the nasal and inferior parts have the best prognosis, those in myopic eyes give the worst results. R. Grunfeld.

Sorsby, Arnold. **Vital staining of the retina.** Brit. Jour. Ophth., 1939, v. 23, Jan., pp. 20-24.

First comes a summary of procedures and investigations in this subject dating back to the sixteenth century. Under the headings of "experimental observations" and "clinical applications" the author presents his findings and technique. The purpose of the article is to demonstrate that the procedure is practicable rather than to show the scope of staining. The fundus appearance in a case of retinal detachment, after intravenous injection of 20 c.c of Kiton fast green V, 10 percent, is shown by a photomicrograph. (References.) D. F. Harbridge.

Tsopelas, B. **Treatment of three cases of occlusion of the central retinal artery with eupaverin Merck.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 830.

In two out of three cases of nonembolic occlusion of the central retinal artery, the spasmolytic action of intravenous injections of eupaverin seemed to have favored recovery of some vision and visual field. The author is encouraged to continue his attempts with eupaverin in the different types of occlusion of the retinal arteries. He lays the greatest importance on very early use of the drug. C. Zimmermann.

Vogt, Alfred. **Subvascular white precipitates in the detached retina.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 864.

These white plaques involving large parts of the detached retina are most numerous in the intermediate zone and may cover the vessels. After operative healing of the detachment they disappeared in all of the author's cases. Their histologic basis is still unknown. C. Zimmermann.

Vogt, Alfred. **Symmetric relations of groups of retinal holes to terminal vessels.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 861.

Vogt has shown that almost all branches of a retinal terminal vessel, may be in relation with holes and grapelike cysts. He now records an emmetropic patient of 50 years in whom these appearances were symmetric in both eyes. The temporal periphery of the left retina presented ten holes, the nasal none. There were some in the temporal region of the right retina. Prophylactically Vogt closed the holes by catholysis and diathermy puncture. Other cases have shown symmetric obliteration of terminal vessels, leading to cystoid degeneration and formation of holes with or without detachment. Many of the author's previously recorded cases of inheritance of retinal detachment illustrated this anatomic predisposition, and the present instance proves such predisposition by symmetric occurrence in the individual.

C. Zimmermann.

Wasserman, I. **New ideas on the treatment of retinitis pigmentosa.** Arch. d'Opht., etc., 1938, v. 2, Dec., p. 1088.

In 1935 Lauber described his treatment of tabetic optic atrophy by lowering the intraocular tension and simultaneously elevating the blood pressure. In 1936 he applied the same treatment with apparent improvement in thirteen cases of retinitis pigmentosa. He has repeated this work in eleven cases of retinitis pigmentosa. In most of them he found the intraocular tension to be above normal. Six of his cases were definitely improved in from two to seven months by miotics and measures to elevate the blood pressure (caffeine, strychnine). Improvement of vision was noted in almost all of the cases. Enlargement of the visual field was found in only three cases. Lowering of intraocular tension is easier to obtain than elevation of blood pressure. (Bibliography.)

Derrick Vail.

Wilczek, M. **Anomalous vascular supply of the retina.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 841.

The right eye of a man of 43 years, which had been blind for a long time, showed with +8.00 sph. an oval violet disc and very narrow arteries emanating from it. Around it was an irregular yellowish-white avascular area, and around this area were numerous gray foci with pigment. Five large and two small arteries emerged here, supplying a large part of the retina. A greyish strand running into the vitreous represented perhaps a remnant of an atypical accessory hyaloid artery. The lens had been absorbed, leaving a small grayish-white granule adherent to the pupillary margin. The white area seemed to be some sort of aplasia of the choroid, and the whole aspect spoke for a malformation due to disturbed development of the retinal pigment epithelium.

C. Zimmermann.

Wright, W. D. **Light adaptation at the fovea for normal eyes.** Brit. Jour. Ophth., 1939, v. 23, Jan., pp. 51-66.

Findings of more than one hundred observers are recorded and analyzed, a new model of the subjective photometer being described. The sensitivity of the right eye in relation to the left when both eyes are dark-adapted, the adaptation factor, and the recovery curve are included in the data presented, as well as results as to reaction to glare, as to the photochemical reaction in the retina, and as to adaptation of the method for pathologic investigations. (Figures, references.)

D. F. Harbridge.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Carillo, R., Malbran, J., and Chichilnisky, S. **Barbituric retrobulbar neuritis.** Arch. de Oft. de Buenos Aires, 1938, v. 13, July, p. 370.

In 1937 Zwillinger and Trotot reported a case of retrobulbar neuritis due to veronal intoxication. This case is summarized by the authors, who in addition report the cases of two sisters who suffered from retrobulbar neuritis after ingestion of luminal taken with suicidal intent. The elder sister, who was addicted to the use of luminal suffered a profound systemic reaction, while the younger sister was less affected, although both took the same amount of drug on this occasion.

In each case there were visual disturbances. The elder sister exhibited nerve-head changes and depression of the peripheral field of vision, especially in the vertical isopters of the left eye. There was also a central scotoma with enlargement of the blind spot in this eye. In the right eye the peripheral field exhibited changes similar to those found in the left eye but in lesser degree. The younger sister showed only an enlarged blind spot in one eye.

The authors conclude that if the pressure within the central retinal artery is low, as determined by the method of Bailliart, the prognosis is unfavorable. Intravenous strychnine therapy is indicated for this type of intoxication, and vasodilator drugs may prove a useful adjuvant. Edward P. Burch.

Dimitriou, T. E. **The relation of tabetic optic atrophy to changes of general blood pressure and intraocular tension.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 704-719.

The specific degenerative character of tabetic optic atrophy is contrary to any explanation of its changes by purely circulatory damage. The latter is not supported either by the fact that an exceptionally benign course of the atrophy occurs in those cases combined with glaucoma simplex. Hypotony of blood pressure is also absent in many of the cases here cited in the writer's own statistics. For normal nutrition of tissue, it is not the height of the diastolic but the average arterial pressure that is significant. In cases of luetic aortic insufficiency, the diastolic pressure may be very low and the intraocular tension relatively high without papillary atrophy occurring.

H. D. Lamb.

Grolman, Gunther von. **Familial pseudo-optic neuritis.** Arch. de Oft. de Buenos Aires, 1938, v. 13, July, p. 368.

Pseudo-optic neuritis occurred in father and son. Edward P. Burch.

Hartman, E., David, M., and Guillaumat, L. **Neurosurgery in certain syphilitic situations with involvement of the optic nerves.** Ann. d'Ocul., 1938, v. 175, Dec., pp. 877-893.

Four cases of syphilis of the central nervous system underwent craniotomy for brain tumor with resultant improvement of the involved optic nerves. Two patients with papilledema, one from frontal-lobe gumma, one from gummatous cyst of the fourth ventricle, were relieved of the papilledema with retention of normal vision. The vision in one case of edema of the brain in secondary syphilis was improved from ⅓ to ⅔ in each eye by decompression. A tabetic showed improvement in visual fields and acuity after operative re-

moval of adhesions from opticochiasmatic arachnoiditis.

John M. McLean.

Sugar, Saul. **Papillitis and papilledema in multiple sclerosis.** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 135-139.

12

VISUAL TRACTS AND CENTERS

Cremer, Max. **Early amaurosis from diffuse cerebral sclerosis.** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 750.

A boy of three years had shown signs of amaurosis for about three months. As the fundi and the pupillary reactions to light were perfectly normal, a process at the calcarine fissure was assumed. Neurologic examination gave negative results. Gradually convulsions and contractions of the limbs and tongue set in, so that the child could take only liquid food. At the age of five years he died. The autopsy revealed a chronic sclerosing process, destruction of all myelin sheaths, fine nuclear fatty degeneration, and perivascular cell infiltrations. C. Zimmermann.

Custodis, E. **Meningioma of the falx; Foster-Kennedy syndrome misleading with regard to localization.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 823.

A man of 41 years complained of frequent headaches since 1933. The right eye showed choked disc with normal vision and visual field. The left eye had vision of 6/60 with absolute scotoma for all colors and relative scotoma for white. The temporal half of the optic disc was pale. Tonic spasm of the facial nerve and paresis of the right abducens developed later. At operation a multicellular meningioma of the falx was removed. It had crowded aside the right frontal lobe of the brain.

C. Zimmermann.

Feigenbaum, Aryeh. **Certain responsive bitemporal disturbances of the field of vision (excluding those caused by true tumors of the pituitary body) in some endocrine-vegetative affections.** Acta Ophth. Orientalia, 1938, v. 1, Oct., p. 28.

Case histories of six female patients are given. They showed a bitemporal disturbance of the field of vision with signs of insufficiency of the pituitary gland but with normal sella turcica. After dehydration therapy the field defects returned to normal. From this the author concluded that the defects were the outcome of swelling of the tissues around the diencephalon, the pituitary body, and the chiasm. The transitory hemianopsic disturbances during pregnancy can be explained upon a similar pathology. R. Grunfeld.

Friemann, Werner. **Rotatory pendulum oscillations, identical with miner's nystagmus, in a tumor of the hypophyseal region.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 848.

A man of forty years complained for three weeks of headache, vertigo, and impairment of sight. Both discs were pale and there was temporal hemianopsia. The roentgenogram showed a widened sella turcica with atrophic dorsum. Roentgen radiation had a good effect on vision. After six months the patient complained of subjective movements and nystagmus when looking upward, but vision had improved to 5/7. The nystagmus disappeared after scopolamine. The observations in this case suggested that damage of the cerebral stem might elicit characteristic pendulum oscillations resembling miner's nystagmus. An inquiry after a year revealed that the oscillations had ceased for several months.

C. Zimmermann.

Löhlein, Walter. **Permanent damage of the visual path in aviation.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 818.

At an altitude of from 5,000 to 6,000 meters, an aviator suddenly suffered from headache, vertigo, and obscuration of the visual fields. After landing he showed vertigo, nystagmus, and right-sided hemianesthesia and hemianopsia, due to a total scotoma from the macula to 40° in each eye. This persisted at examination after three months. Vision was 4/4. The disturbance was attributed to rupture of a cerebral blood vessel in the visual path above the optic tract, due to circulatory change at high altitude.

C. Zimmermann.

Ohm, J. **Remarks on the article by Friemann (see above).** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 852.

Ohm assumes that in Friemann's case the nystagmus was not caused by the hypophyseal tumor itself or by changes in its immediate neighborhood, but by remote action of a disturbance in the vestibular nuclear apparatus.

C. Zimmermann.

Velhagen, K., Jr. **Indirect heteronymous hemianopsias.** Klin. M. Augenh., 1938, v. 100, Dec., p. 801.

The author shows, on a series of cases, that bitemporal and binasal defects of the visual fields occur as indirect and remote symptoms of processes increasing intracranial pressure which are not located near the chiasm. The question is discussed how far these disturbances of the visual fields may be caused by damage to the sella from increased intracranial pressure. Here hydrocephalus of the third ventricle probably plays the chief part. The possibilities of differential diagnosis between indirect and direct heteronymous hemianopsias and direct and indirect destruction of the sella are considered.

C. Zimmermann.

13

EYEBALL AND ORBIT

Hay, P. J. **A note on the use of horse-hair sutures for the conjunctiva.** Brit. Jour. Ophth., 1939, v. 23, Jan., pp. 43-44.

The author has found the use of horse-hair sutures useful for closing the wound after inserting the glass globe in a Frost-Lang operation. The advantages are that no knot is needed and there is no bunching of the conjunctiva. The technique is described. (Figures.)

D. F. Harbridge.

Krause, A. C., and Buchanan, D. N. **Dysostosis cranio-facialis (Crouzon).** Amer. Jour. Ophth., 1939, v. 22, Feb., pp. 140-144.

Leydhecker, F. K. **A family with congenital microphthalmos.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 790-792.

Study of five generations, including 47 members, showed six males and four females affected with microphthalmos. The loss of vision always occurred about the age of forty years.

H. D. Lamb.

14

EYELIDS AND LACRIMAL APPARATUS

Bonnet, P., and Bonamour, G. **Lymphangiectic abscess of upper lid after epilation.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 430.

Of interest because of the custom of plucking the eyebrows.

Harmon Brunner.

Bourguet. **Anatomical ablation of the lacrimal sac.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 295-298.

The author discusses the anatomy of the lacrimal sac, and describes removal in the capsule, without the capsule, and by a mixed type of operation.

Clarence W. Rainey.

Grandclément, and Bonnet, P. **Recurring herpes of the lids, chancriform in type.** Bull. Soc. d'Opht. de Paris, 1937, July, p. 412.

In a girl of eleven years herpes recurred frequently for several years on the upper lid margin. The lesions swelled and formed pustules and then ulcers with hard raised borders, which took on a brownish color.

Harmon Brunner.

Klikova, O. L., and Tokareva, B. A. **The Blaskovics ptosis operation in the Moscow Eye Hospital.** Viestnik Opht., 1938, v. 12, pt. 4, p. 495.

Twenty-four operations convince the authors that the Blaskovics operation is the best one for ptosis and is indicated in all cases. Ray K. Daily.

Kostenko, P. G., and Kopit, P. Z. **The pathology of the lacrimal sac in trachoma.** Viestnik Opht., 1938, v. 12, pt. 4, p. 505.

A detailed report of the microscopic examination of 33 extirpated lacrimal sacs, nine of which were from cases of trachoma. The authors conclude that the microscopic picture of dacryocystitis in patients with trachoma has no characteristic features. (Photomicrographs.) Ray K. Daily.

Michail, D., and Zolog, N. **New research concerning the action of adrenalin on the lacrimal elimination of glucose.** Bull. de l'Acad. de Méd. de Roumanie, 1938, v. 5, no. 4, pp. 607-612.

The injection of adrenalin into the lacrimal gland alone or associated with a subcutaneous injection produces bilateral excretion of glucose in the tears, more apparent on the side on which the gland has been injected. Conjunctival instillation of adrenalin produces hyperglycemia but no lacrimal excretion of glucose, presumably because of reflex inhibition. The ability of adrenalin to cause lacrimal elimination of glucose is decreased in simple glaucoma. This becomes more apparent as the glaucoma approaches the absolute stage. John C. Long.

Saburov, G. I. **A case of neurofibroma of the upper lid and nodules in the iris in Recklinghausen's disease.** Viestnik Opht., 1938, v. 12, pt. 4, p. 557.

A report of a case in a thirteen-year-old girl. A Blaskovics operation was performed for ptosis, without cosmetic result. Microscopically, between the epithelial and meibomian glands, the muscle and cartilage excised during the operation showed numbers of horizontal and vertical nerve strands. The enlargement of the nerve strands was caused by proliferation of the perineurium and endoneurium.

Ray K. Daily.

Subileau, J. **Twin trephining in dacryorhinostomy.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 342-351.

The author modified a trephine instrument used by Arruga, so as to produce twin trephine openings, 9 mm. in diameter, in an operation for dacryorhinostomy. All the osseous surface corresponding to the lacrimal groove is removed, including the anterior and posterior crests. The edges of the bone

are smoothed off with bone forceps. No case reports are given.

Clarence W. Rainey.

Weeks, W. W. **Ectropion and entropion of the eyelids.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 78-82.

The author outlines several of the classical procedures for the correction of ectropion and entropion and gives his opinion of each. The illustrations are an outstanding feature of this article. (5 figures, 3 references.)

Ralph W. Danielson.

Wheeler, J. M. **The use of the orbicularis palpebrarum muscle in surgery of the eyelids.** Amer. Jour. Surg., 1938, v. 42, Oct., pp. 7-9.

The paper describes the use of the orbicularis in correcting congenital absence of the external canthal ligament, ptosis of the upper lid, and spasmodic inversion of the lower lid. (6 figures.)

Ralph W. Danielson.

Zikulenko, K. I. **Egg white in ocular surgery.** Viestnik Opht., 1938, v. 12, pt. 4, p. 511.

The author substitutes hard-boiled egg-white for mucous membrane from the lip in marginoplastic surgery. His observations lead him to believe that the mucous membrane transplant merely serves as an obstruction to adhesion of the two opposing surfaces, and thus permits ingrowth of connective tissue. He finds that egg white acts as a hemostatic and adheres firmly to the cut surfaces. When the intermarginal area has become filled in with connective tissue the egg white is extruded.

Ray K. Daily.

15

TUMORS

Dupuy-Dutemps, Pierre. **Radium therapy of meibomian epitheliomas.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 298-302.

The author reports the favorable results obtained in the treatment of two patients having meibomian epithelioma. The radium caused rapid disappearance of the local lesion, and swelling of the preauricular lymph gland. Surgical removal of the submaxillary lymph glands, followed by more radium, produced apparent cure, after four years observation.

Clarence W. Rainey.

Evans, P. J. **Radon treatment of secondary carcinoma of the choroid, post-mortem observations.** Brit. Jour. Ophth., 1938, v. 22, Dec., pp. 739-745.

This is the subsequent history of a case described by the author in 1937 (see Amer. Jour. Ophth., 1938, v. 21, Jan., p. 106), at which time the use of radon seeds in the treatment of secondary carcinoma of the choroid in a woman aged 41 years was reported. In 1937, treatment was being given the remaining eye, the first having been enucleated in January, 1936, for the same condition. During the major portion of the period here covered good vision was maintained, ultimate failure of vision being due to intracranial complications involving the optic nerve. In otherwise hopeless conditions, radon seeds may prove a worthy alternative to removal of the eye. Post-mortem findings are described in detail. (Figures.)

D. F. Harbridge.

Kalt,. Marcel, and Tille, H. **Symmetric lymphoma of the two semilunar folds, a symptom revealing lymphoid leukemia.** Bull. Soc. Franç. d'Opht., 1938, v. 51, pp. 364-372.

A 66-year-old man presented two kidney-bean-sized reddish tumors, one at each semilunar fold. The right tumor mass was removed surgically, and was

found to have the microscopic structure of a lymphoma. Other positive findings in the physical and laboratory examinations indicated leukemia of the chronic lymphoid type.

Clarence W. Rainey.

Koyanagi, Y. **Tumor-like proliferation of the retinal pigmented epithelium in metastatic carcinoma of the choroid.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 732-742.

In a man 37 years old, with a primary carcinoma of the right lung, there occurred a metastasis in the choroid of the left eye, just around the optic nerve. Along the under side of the detached retina just internal to the choroidal carcinoma, was observed a membranous formation composed mostly of pigmented cells derived from the retinal pigmented epithelium. Numerous mitotic figures were present among these cells, but no connective tissue.

H. D. Lamb.

Lange, Helmut. **Retinal glioma with special consideration of its heredity.** Klin. M. f. Augenh., 1938, v. 101, Dec., p. 854.

This is a report on 36 cases of retinal glioma observed in the last 22 years at the Halle eye clinic. Twenty patients, or 44.4 percent, are still living. Of patients with monolateral glioma, 76 percent were cured. The mortality of bilateral glioma is much higher. Tables show beginning of the disease at various ages from one to nine years. The investigations show that retinal glioma may be hereditary. In the hereditary cases it was bilateral. In the clinic glioma occurred in 0.0217 percent of all eye patients. Three cases are described in detail. C. Zimmermann.

Oribe, M., and Malbran, J. **Anatomical and clinical consideration of retinal glioma.** Arch. de Oft. de Buenos Aires, 1938, v. 13, June, p. 319.

The authors present a very comprehensive review of the historical background of retinal glioma, and report five cases. The gross and microscopic appearances of this group of tumors are described in detail, with their clinical behavior. The theories of rosette formation are quite fully discussed and also the analogy between certain tumors of the central nervous system and those occurring in the retina. The authors advance the hypothesis that there are three distinct varieties of retinal glioma. The first is a highly malignant type which they would designate as retinoblastoma and which is held to be analogous to medulloblastoma of the central nervous system. The second type, which is benign, is the retinocytoma. The analogous neoplasm of the nervous system is the astrocytoma. Third, there is a tumor of neuroblastic rather than glial origin. (Illustrated.)

Edward P. Burch.

Paiva, Aroldo. **Malignant melanosis of the ciliary body.** Arch. de Oft. de Buenos Aires, 1938, v. 13, July, p. 363.

A case of malignant melanosarcoma of the ciliary body is reported by the author. After enucleation the sections were subjected to study, but the exact cell type of the neoplasm could not be determined. (Illustrations.)

Edward P. Burch.

Siegert, Peter. **Melanosarcoma of the iris.** Graefe's Arch., 1938, v. 139, pts. 4 and 5, pp. 591-639.

There are reported three cases of simple sarcoma of the iris in varying stages of development. In the first case, sarcoma cells have developed among the chromatophores of a pigmented nevus of the iris. The remaining two

cases are of flat, malignant pigmented tumors of the iris. In melanosarcoma of the iris, there frequently exists considerable discrepancy between the clinical and anatomic findings of malignancy. Such a growth may develop without producing any symptoms. On the other hand, even where a sarcoma of the iris causes loss of vision from glaucoma, no destructive growth or metastasis may exist. Roentgen raying does not appear to guarantee lasting results. Metastasis of the generally very slowly growing tumor apparently occurs along preformed tissue clefts and perivascular lymph spaces. Sarcoma of the iris may be considered with overwhelming probability to be of mesodermal origin. H. D. Lamb.

Susman, William. **Intraocular tumors.** Brit. Jour. Ophth., 1938, v. 22, Dec., pp. 722-739.

There are essentially three types of intraocular tumor: retinal tumors of neural origin, sarcomata of the choroid with choroidal differentiation, and melanomata of the choroid. Retinal tumors may be designated as neuroepithelioma, apolar spongioblastoma, polar spongioblastoma, neuroblastoma, and neurocytoma. Sarcoma of the choroid should be considered as malignant choroidoma. Melanomata are few by comparison and are designated by typical branched melanotic cells. Pigment is not diagnostic of a melanoma, as it may be present in many retinal tumors, its presence merely indicating that the growth has disturbed the choroid. The types of tumor are fully described, and results outlined. (Figures, tables, references.) D. F. Harbridge.

Teulières, M., and Beauvieux, J. **Fibroma of the sclerotic.** Arch. d'Opht. etc., 1938, v. 2, Dec., p. 1073; also Bull. Soc. Franç. d'Opht., 1938, v. 51, p. 372.

Examination of the right eye of a five-year-old boy disclosed a reddish, swollen, indurated roll of tissue occupying the entire cul-de-sac. Vision was 3/10 after the overlying conjunctiva was mobile. The mass was intimately attached to the eyeball (which was proptosed downward over the superior-rectus tendon). It was removed under local anesthesia. Diplopia disappeared and at the end of a few months the vision became normal. Pathologic examination showed a nonmalignant fibroma rich in blood vessels. (Illustration, references.) Derrick Vail.

16

INJURIES

Bruhn, A. M. **Clinical and experimental investigations on eye lesions by burr hairs.** Klin. M. f. Augenh., 1938, v. 101, Nov., p. 730.

Eight cases of lesions by the pappus hairs of burrs in late summer at the time of maturity and opening of the burr baskets are described. The typical clinical picture consisted of loosening and papillomatous hypertrophy of the conjunctiva, especially the upper fornix, formation of pseudomembranes on the conjunctiva of the upper lid, and erosions and herpetic changes of the cornea. If the burrs remained they caused formation of granulomata. Introduction of burr hairs in the conjunctival sacs of animals produced similar conditions. Injection of oily extracts into the outer layer of the cornea showed no effect, but aqueous extracts produced violent reactions. Hence a chemical poison soluble in water is inferred, supplementing the mechanical irritation.

C. Zimmermann.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
640 S. Kingshighway, St. Louis

News items should reach the Editor by the twelfth of the month

Deaths

Dr. Walter Lewis Horn, New York City, died December 29, 1938, aged 47 years.

Miscellaneous

The National Society for the Prevention of Blindness has announced that it is coöperating with the following colleges and universities in offering, at their 1939 summer sessions, courses for the preparation of teachers and supervisors of sight-saving classes:

Western Reserve University, Cleveland, Ohio, June 19th to July 28th. Director of the course, Miss Olive S. Peck, Supervisor, Braille and Sight-Saving Classes, Board of Education, Cleveland, Ohio.

State Teachers College, Buffalo, New York, June 26th to August 4th (dates tentative). Director of the course, Miss Agnes Reuter, Department of Special Education, Buffalo Public Schools, Buffalo, N.Y.

State Teachers College, Milwaukee, Wisconsin, June 26th to August 4th. Director of the course, Miss Marguerite L. Kastrup, Supervisor of Braille and Sight-Saving Classes for Northern Ohio, Cleveland, Ohio.

University of California, Los Angeles, California, June 26th to August 4th. Director of the course, Miss Frances Bland, Principal of Sight-Saving Classes, Los Angeles City Schools, Los Angeles, California.

Wayne University, Detroit, Michigan, June 26th to August 4th (elementary and advanced courses). Director of the elementary course, Mrs. Gladys Dunlop Matlock, Detroit, Michigan. Director of the advanced course, Mrs. Winifred Hathaway, Associate Director, National Society for the Prevention of Blindness, New York, N.Y.

Details regarding the courses may be obtained from the university or college, or from the director in charge of the course.

Societies

The mid-year meeting of the North Dakota Academy of Ophthalmology and Otolaryngology was held at Fargo, February 11th. Dr. Avery D. Prangen of the Mayo Clinic, as guest speaker, addressed the group on "Some fundamental problems of refraction."

The Eye Section of the Philadelphia County Medical Society presented the following program on March 2d: The optic atrophy in pituitary disease, by Dr. M. W. Thorner; Pathology of the subchoroidea with microscopic projection, by Dr. Perce DeLong.

"The American Physicians' Art Association composed of members in the United States, Canada, and Hawaii, will hold its second Art Exhibit in the City Art Museum of St. Louis, May 15 to 20, 1939, during the annual meeting of the American Medical Association. Art pieces will be accepted for this art show in the following classifications: (1) oils both (a) portrait and (b) landscape; (2) water colors; (3) sculpture; (4) photographic art; (5) etchings; (6) ceramics; (7) pastels; (8) charcoal drawings; (9) book binding; (10) wood carving; (11) metal work (jewelry). Practically all pieces sent in will be accepted. There will be over 60 valuable prize awards. For details of membership in this Association and rules of the Exhibit, kindly write to Max Thorek, M.D., Sec'y, 850 Irving Park Blvd., Chicago, Ill., or F. H. Redewill, M.D., Pres., 521-536 Flood Bldg., San Francisco, Calif."

The Los Angeles Society of Ophthalmology and Otolaryngology announces the following officers for 1939: President, Dr. Pierre Viola; Vice-President, Dr. Henry B. Lemere; Secretary-Treasurer, Dr. John P. Lordan; Committeeman, Dr. M. N. Beigelman. Meeting place, Los Angeles County Medical Association Building, 1925 Wilshire Blvd., Los Angeles. Time, 6:00 p.m., fourth Monday of each month from September to May, inclusive.